GAS JOURNAL

LIGHT ✂ HEAT ✂ POWER ✂ BYE-PRODUCTS

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VOL. CLXXXVIII. No. 3475.] WEDNESDAY, DECEMBER 25, 1929. [81ST YEAR.

Editorial Notes.

Politics and Coal.

PERHAPS the strangest feature of the debate on the second reading of the Coal Mines Bill was the Prime Minister's complaint, in his winding-up speech, that opposition to the Bill had been political, rather than based upon its merits and its practicability. This was indeed a strange attitude to assume, when it is realized that the whole *raison d'être* of the Bill is to find means to redeem a political promise by the Prime Minister's party of a shorter working day for the miners which, economically, is indefensible. On general lines, the debate followed the arguments advanced in our comment last week, and it is satisfactory to know that, although the second reading was passed—albeit by an exceedingly small margin—the two opposition parties are united in their objections to the principle of squeezing the home consumer because the foreigner cannot be squeezed. It is therefore to be hoped that they will together forge into the Bill in its Committee stages some genuine safeguards for the industries of the country even if, at the present moment, its whole structure appears to rest on the power given to the coal industry to square its accounts by regarding inland prices as an adjustable figure.

One of the chief debating points was as to whether the selling schemes are to be regarded as permanent, or as a temporary expedient. But, even if they are for a very short duration, they must inevitably cause disorganization and confusion; and a large consuming industry like ours cannot possibly be run on a hand-to-mouth coal-buying policy. As to the amalgamation question which was made much of by one of the parties, it will be interesting to follow developments in this direction. While deprecating on general principles an attempt, such as is suggested, to coerce any industry into any particular policy, we cannot help feeling that there is much to be done in this way towards the prosperity of our great national asset, although we fully realize the difficulties of individuals in the matter. We would, in any case, far more readily accept the strong selling policy which could be adopted by national groups of collieries, and which would at least embody ordinary commercial principles, than a charge-what-you-will scheme backed by the full force of the law, if not by the will of the people.

In the debate, as so often happens in discussions of coal subjects, the level frequently descended to the case of the consumer of a few tons of raw coal in his domestic grate. After all, his case must be stated; it is easily stated, and it is a popular grievance. We feel sure that the gas industry, between now and the final passing of legislation in some shape or form, will put its case clearly not only before the House, but also before its 8½ million consumers. Do they all grasp *now* the full implication of an increase in the price of coal?

World Power Conference, Tokyo.

THE proceedings of the Sectional Meeting of the World Power Conference, held in Tokyo from Oct. 29 to Nov. 7, were smooth and successful; and those who attended from "abroad" owe a debt of gratitude to the Japanese Government not only for the excellent arrangements made for the technical discussions at the meeting proper, which triumphantly commenced with an address by His Imperial Highness Prince Chichibu, but for the gracious and generous hospitality which marked the event from start to finish.

The Conference, which was convened for discussion of the development of power resources, was divided into two categories, general and sectional; and as far as our readers are concerned, interest attaches mainly to Section A (*a*), which comprised five contributions. A lengthy extract from one of these—"The Evolution of the Continuous Vertical Retort," by Sir Arthur Duckham—is published in later columns to-day. The other papers were as follows: "A Contribution to the Study of the Carbonization of Coal," by E. Audibert; "Coal Studies," by P. E. Raaschou; "Gas Liquor Effluents," by Dr. A. Parker; and "Enrichment of Methane in Coke Oven Gas," by M. Louis and A. Chmelevsky.

The story of the rapid growth of the vertical retort, once it had passed the experimental stage, is of great interest; and Sir Arthur Duckham's description of the new installation of "W-D" verticals at the works of the Tokyo Gas Company is indication of the strength and wisdom of the policy which has always animated the Woodall-Duckham Companies—steady application of fundamental scientific principles to carbonization; continuous building for the future; co-operation with users of the plant. M. Audibert, whose work must be well known to many of our readers, discussed the mechanism of fusion and the progress of aggregation of coal agglomerate during carbonization, and proposed two methods for assaying coal for coke-making. One is a scale for measuring the agglutinating coefficient of coal, and the other is a system of foretelling coke structure by laboratory study of coke cleavage. Mr. Raaschou described a high-temperature extraction method for determining the components of coal, employing high-boiling solvents such as naphthalene and aniline; while Dr. Parker reviewed the gas-works effluent problem. MM. Louis and Chmelevsky dealt with the enrichment of coke oven gas by methane by means of diffusion through porous materials; they explained the beneficial results which followed the introduction of carbon dioxide into the coke oven gas, and suggested that the use of superheated steam may assist in attaining the theoretical enrichment.

In Section B (*a*) of the Conference—which considered the "rational unification and economical administration of

electric power development"—there was an interesting paper by Koji Goto entitled "Supply and Consumption of Gas and Electricity for Domestic Use in Tokyo," which, however, was not quite so redolent of optimism concerning gas as was the paper by Sakura Okamoto before the World Power Fuel Conference in London in October, 1928—see "JOURNAL" for Oct. 3, 1928. An extract from Mr. Goto's contribution will be found in later columns of our issue to-day. He gave the reason why electric light is in general use, and mentioned that gas is popular in Japan because it has proved the most economical for heating purposes, and because the service is reliable. The greater consumption of gas in the future, he said, is chiefly dependent on lower charges and a better understanding of fuel costs in relation to the total cost of living.

On Nov. 7, a luncheon to commemorate the successful termination of the Conference was given by the Japanese National Committee, and all the "foreign delegates" who spoke expressed their appreciation of the cordiality of the reception which had been accorded them.

Inner Structure of an Opaque Substance.

A PIONEER in the application of X-rays to the examination of coal and coke, Mr. C. Norman Kemp recently lectured on this subject before the Royal Society of Arts. He reviewed the history of this application, which appears to be of great promise, described the development of his "Carboscope," which is a surprisingly simple piece of apparatus, outlined the new stereoscopic technique advanced by Mr. Leslie Thomson and himself, and recounted a few of the commercial uses of his method.

The spectroscopic technique of X-ray examination is particularly interesting. Two radiographs of a specimen are made on separate films which are then viewed in an instrument which enables the observer to examine the coal or coke as if it were a translucent mass. With coal, the combustible portion, Mr. Kemp explained, yields a more or less undifferentiated solid field, within which, according to size, shape, density, and distribution, may be seen the mineral matter present. A radiograph of a section may exhibit a region where the total radiographic density at the point under consideration is not that due to the coal *plus* a particular mineral mass contained within it, but is due to the coal *plus* two such masses so disposed that they have been radiographically superimposed. In such an instance, as in many others, a single negative would lead to misinterpretation, while a stereoscopic pair would at once space out the two inorganic masses involved, and exhibit them in their actual relative positions in space.

Mr. Kemp has been working in conjunction with the Fuel Research Division since 1924; and from the latest report of the Fuel Research Board, it is evident that X-ray examination of coals provides a rapid means of determining the nature and distribution of the ash, and also of estimating approximately its amount. Also, as indicated in the foregoing paragraph, the structural characteristics of the ash may be studied by stereoradiographs. Regarding the nature of the ash, as the absorption of X-rays by an element varies with the fourth power of its atomic number, it is possible to differentiate between the kinds of impurity present. An X-ray examination of a coal to be cleaned, for example, may reveal the amount of "inherent" or "constitutional" ash (derived from the original plant debris) which, because of its fine state of division, cannot be removed by washing, and will therefore decide the minimum ash content obtainable in the clean coal. Mr. Kemp exemplified the utility of this in relation to practical coal-washing tests. A series of tests made on supplies of small coal showed that the cleaning plant could lower the shale content to a reasonable figure, but that, on average, it failed to do so; and the average ash content of the coal actually supplied as a washed product could in many cases have been halved. Another investigation of a coal containing "middlings" demonstrated the large increase produced in the average ash content of each piece by a comparatively small proportion of shale, and showed how slight crushing would ensure almost perfect separation of coal and shale.

In later columns, we publish an extract of a lecture, delivered by Dr. C. H. Lander, Director of Fuel Research, before the Institute of Physics. He referred to the work at present being undertaken to correlate, by physical means, graphitic structure and reactivity of coke. The X-ray spectrometer has been applied to four widely different varieties of coke; and Dr. Lander explained that the results indicate a parallelism between the size of the graphite crystals, as indicated by the shapes of the resultant reflection curves, and the reactivity of the coke, as determined by the Fuel Research Station method; the most reactive coke apparently being made up of the smallest crystals, and *vice versa*.

Sufficient has been said, we hope, to indicate that the X-ray method of ascertaining the inner structure of an opaque and heterogeneous substance such as coal or coke is of practical, as well as academical, importance—that the use of X-ray equipment in (say) a coal cleaning plant is not similar to buying a racehorse to do a donkey's work. Finally, we would inform our readers that the full text of Mr. Kemp's lecture was published in the Journal of the Royal Society of Arts dated Dec. 13.

Laboratory Approval Seals.

A SYMBOL which is known as the "Laboratory Approval Seal," when affixed to a gas appliance indicates that it has been approved by the Canadian Gas Association. This approval plan is worth noting, as the requirements to be met have been laid down by efforts to ensure, first of all, satisfactory and safe performance of the appliance when in actual use. We have received from Mr. G. W. Allen (Secretary-Treasurer of the Association) a copy of the first edition of the list, which contains the names of fourteen manufacturers and distributors of gas appliances and equipment in Canada who have been awarded this seal, showing that their products have been tested and not found wanting. Certificates of Approval are good only for the year in which they are made out, and are renewable annually, when a fresh inspection of the apparatus will be made. This is to secure maintenance of quality. Every three months a complete revised catalogue is to be issued.

The Committee who draw up the requirements for the Laboratory Approval Seal represent the gas company and the manufacturer members of the Canadian Association, the American Gas Association, the United States Bureau of Standards, Bureau of Mines, and Public Health Service, the National Association of Heating and Piping Contractors, and the Master Plumbers' Association. The tests relate to construction and performance; and while most of the former have at least an indirect bearing on safety, in many instances they also fix minimum weights of material permissible, and, by reason of this, ensure reasonable durability. So far as the customer is concerned, the performance tests, provided the appliance is properly installed and intelligently used, guarantee a satisfactory operating efficiency and safety from leakage of gas, from explosion, from fire hazard, from incomplete combustion, &c. The scheme is one which should be in the interests of Canadian manufacturers and of the consumers alike.

"Incidental" Advantages of Gas.

THE thing to remember is that we are only on the threshold of our knowledge of what gas can do to help itself and industry at the same time. We shall have to inquire still further into the "incidental" advantages, and, having gained more knowledge, lose no time in employing it to good purpose by organized sales effort conducted by capable sales engineers. Lately we read a paper by Mr. W. E. Jominy, a Research Investigator attached to the American Gas Association, bearing the formidable title of "The Influence of the Constitutional Characteristics of Steel on the Design of Forging Furnaces." It sounds academic, and the work was carried out at the University of Michigan. But the outcome of the research is eminently practical; it sheds light on the incidental advantages of gas when used in forging processes. It is, in fact, modern gas salesmanship.

A successful attempt has been made to consider the

fundamental differences between the results obtained when using gas and those obtained when employing oil as a fuel. If a furnace is well insulated and designed, and is fired by gas, what advantage will it have over a furnace equally well insulated and designed, and fired with oil? There are two main points of difference: First, it is possible in a gas-fired furnace to obtain a uniform atmosphere and to control this atmosphere; secondly, since the burners can be placed almost anywhere along the heating chamber, it is possible in a gas furnace to obtain great uniformity of temperature. A point of less importance is that oil, being a liquid, throws a longer flame than does gas, and, therefore, if flame is to be avoided in the heating chamber, a larger space for combustion must be provided.

One object of the research was to determine whether these points of difference were advantages such as would favour the use of gas as a fuel in the heating of steel for forging. Gas was declared the winner. Another object was to determine what rates of heating, and what temperatures and atmospheres, are most desirable in a forging furnace; and it was demonstrated that gas facilitates the realization of certain hitherto inadequately recognized metallurgical requirements of the forging process. Such information adds another weapon to the armoury of gas in its fight for the industrial load, for it assists in satisfying one of the primary "incidentals"—a better product. The research indicates the scope for improvement in the present forging furnace and in the quality of forgings, and the need for educational work to bring the forge shops to a full realization of the importance of controlled heating. Through the use of gas, steel may be heated to just below danger point with safety and at greater speed.

Steel forging is, needless to say, only one phase of the possibilities of controlled gaseous firing. Innumerable instances could be mentioned where the adoption of temperature control renders fuel saving considerations negligible. For example, where inflammable materials are being heated either as part of the ware being produced (such as japanning, enamelling, or lacquering of metal) or as the ware itself (such as oils and varnishes), control of temperature is a necessity from the fire hazard point of view alone. Again, in the tempering of needles, temperature control is the essential feature of the process. In the "SALESMAN" for Nov. 13, Mr. A. W. Smith, the General Manager of the Birmingham Gas Department, explained the manufacture of the latch needle used on automatic knitting machines. The degree of hardness and the composition of the steel had to be very carefully watched. The latch portion has to be hardened at a different temperature from the pin which connects it to the shaft, and the shank to a still different temperature; while all three are composed of different grades of steel. "You will," said Mr. Smith, "realize the advantage which gas gives in the control of temperatures for work of this description." Let us hope that manufacturers in general will before long assess at their true value other "incidental" advantages of gas.

William Cartwright Holmes Scholarship in Gas Engineering.

Through the generosity of Mr. P. F. Holmes and Mr. D. M. Henshaw, of Huddersfield, there has been placed in the hands of the Institution of Gas Engineers a fund for the purpose of endowing a scholarship to be called the William Cartwright Holmes Scholarship, which shall be tenable at the University of Leeds by a student taking a course in preparation for a responsible position as a gas engineer. The scholarship is of the value of £150 per annum for three or four years. It will so provide rather more than £100 a year towards maintenance after payment of the University fees, and will on that account be one for which any promising boy or young man who is interested in Fuel Technology as a career may well become a candidate. The Institution have formed a Committee for the administration of the fund; and at their first meeting, the donors placed it upon record in the Minutes that "their first desire was to perpetuate the name of William Cartwright Holmes, and secondly to show appreciation of the training obtained by students of Gas Engineering at Leeds University, and of the valuable research work done in the Department of Coal Gas and Fuel Industries." The foundation of such a scholarship is a very practical means of assisting to meet the national need existing at the present time for trained fuel technologists which was stressed by the National Fuel and Power Committee in their recent report, and by Prof. Cobb in his last report as Livesey Professor of the Department of Coal Gas and Fuel Industries in the University of Leeds.

The "Gas Salesman" Supplement.

With this issue we arrive at a parting of the ways, inasmuch as henceforth the "Gas Salesman" will not be printed as a supplement to the "JOURNAL," but will appear as a separate monthly paper, with a practically limitless field of usefulness. Our experiment with it in the form of a supplement has furnished abundant proof of the need for a publication of this sort devoted to the sales side of the industry.

A Note in Passing.

This is a season of good will, and we have no desire to indulge in acrimony; but when it is implied by a technical writer that coal carbonization as carried out in gas-works is wasteful of our coal resources, we must make a mild protest. After indulging in figures which we conclude have been printed in error, "Hotspot" of the "Electrical Times" (Dec. 5, p. 1004) states: "It may be that electric power generation involves destruction of a greater quantity of coal, but, on the other hand, it is probable that gas production is more destructive of the nation's wealth, as represented by its coal resources." No amount of polemic, however, can alter the fact that carbonization of coal as practised in gas-works is the most efficient energy conversion process known. It is a question not of destroying coal resources, but of converting them into more valuable fuels without appreciable loss.

Electrical Plant in Gas-Works.

Useful information on this subject is contained in a paper by Mr. W. E. Stephenson, of South Bank, before the Yorkshire Junior Gas Association—see later pages of the "JOURNAL" to-day. The time is past when gas engineers looked askance at the utilization of electricity in the process of gas manufacture; to-day, in general, only the smallest works are without a supply of electricity, which in most instances is generated from so-called "waste heat." The time is past, too, when the gas engineer could afford to exclude from his professional repertoire a working knowledge of commutators, alternators, convertors, and so on. He now has to know what to select, how best to apply his selection, and how to maintain it economically. "Press the button" is a phrase which causes no consternation in the modern gas-works; nor can there be any regret at the passing of an attitude of ultra-conservatism which did little credit to its holders.

Leon Gaster Memorial Fund.—Two months have elapsed since the opening of the above fund, designed to commemorate the founder of the Illuminating Engineering Society, primarily by the award of an annual premium for the best contribution on illuminating engineering submitted to the Society. We understand that the appeal has met with a prompt and generous response. One gratifying feature has been the manner in which corresponding members in other lands have come forward. There is already a good prospect of the minimum necessary sum being attained.

Utilization of Coal-Tar Crudes.—One of the chief obstacles to the production of vat dyes derived from anthraquinone has been the difficulty of obtaining high-grade anthracene from the crude material; and in a paper before the Second International Conference on Bituminous Coal, A. O. Jaeger explained that a specific separating solvent for anthracene has been found in furfural. By dissolving crude anthracene in furfural at elevated temperatures, and cooling the liquid, anthracene of excellent quality for direct vapour-phase oxidation to anthraquinone separates out. The solvent may be recovered and the losses of both solvent and solute are slight.

PERSONAL.

The marriage was solemnized at Llandaff Cathedral, Cardiff, on Tuesday, Dec. 17, between Captain Geoffrey F. Falk, T.A., second son of Mr. Max Falk (Chairman of Messrs. Falk, Stadelmann & Co., Ltd.) and Mrs. M. Falk, and Kathleen, elder daughter of Mr. H. D. Madden, M.Inst.C.E. (Engineer and Manager of the Cardiff Gas Light and Coke Company, and Chairman of the South Wales Branch of the Institute of Mechanical Engineers), and Mrs. Madden. During the afternoon, Mr. and Mrs. Madden received a telegram from Mr. C. S. Shapley, President of the Institution of Gas Engineers, reading as follows: "The President and Executive of the Institution assembled wish your daughter every happiness on her marriage."

The Board of Trade have appointed Mr. JAMES HENDERSON to be a member of the Area Gas Supply Committee in the place of Mr. M. MANNABERG, who, through ill-health, is unable to continue to serve on the Committee.

SOCIETY OF BRITISH GAS INDUSTRIES.

Council Meeting.

A Meeting of the Council was held at 56, Victoria Street, Westminster, S.W., on Tuesday, Dec. 17—Mr. C. A. GOODALL, the Chairman, presiding. Those present were Mr. Frank West (Vice-Chairman), Col. E. A. Wilson, Messrs. F. J. Gould, H. E. Bennet, B. B. Waller, Ernest West, W. J. D. Howell, R. J. Milbourne, G. Ewart, H. M. Thornton, E. J. Davison (Hon. Secretary), and Arthur L. Griffith (Secretary).

Apologies for absence were reported from Dr. E. W. Smith, Major R. Miles, Messrs. E. J. Cox, G. Clark, G. J. Jackson, R. B. Hodgson, and F. C. Tilley.

An application for membership was submitted from Gas Chambers and Coke Ovens, Ltd., London; and they were unanimously elected members under Sections I., II., III., and XII.

The following were nominated as the Society's representatives on the Grand Council of the Federation of British Industries:

Main Group 2,	Sub-Group 5	Mr. E. J. Davison
,, ,, 2,	,, 12	Mr. Samuel Cutler
,, ,, 2,	,, 13	Mr. Charles Clare
,, ,, 15,	,, 1	Mr. F. C. Tilley

The proposed Washington Hours Convention Bill was brought up and discussed, and the members of the Council were requested to watch the matter very closely, and report to the Council from time to time so that the interests of members of the Society may be protected.

A report was submitted from the Federation of British Industries with list of the alterations recently made in the Australian Customs Tariff, and was discussed. It was decided to refer the matter to the members of the Society, so as to ascertain their views on the new proposals.

FORTHCOMING ENGAGEMENTS.

[*Secretaries of Gas and Kindred Organizations are asked to assist in making this diary of events as complete and useful as possible by sending the earliest intimation of all meetings.*]

Jan. 9.—MIDLAND JUNIOR GAS ASSOCIATION.—Meeting in the Council House, Birmingham. Address by Prof. F. W. Burstall, Vice-Principal, Birmingham University, on the "Present Position of the World's Fuel."

Jan. 11.—SCOTTISH JUNIOR GAS ASSOCIATION (WESTERN DISTRICT).—Joint meeting with Eastern District at Edinburgh. Address by Mr. H. J. Toogood, of Elland.

Jan. 11.—SCOTTISH JUNIOR GAS ASSOCIATION (EASTERN DISTRICT).—See Western District.

Jan. 11.—WESTERN JUNIOR GAS ASSOCIATION.—Meeting at Bristol. Paper by Mr. M. Barash, of West's Gas Improvement Company.

Jan. 11.—LONDON AND SOUTHERN DISTRICT JUNIOR GAS ASSOCIATION.—Visit to the Wandsworth Works of the Wandsworth, Wimbledon, and Epsom District Gas Company.

Jan. 14.—NATIONAL GAS COUNCIL.—Meeting of Central Executive Committee.

Jan. 14.—FEDERATION OF GAS EMPLOYERS.—Meeting of the Central Committee.

Jan. 16.—SOCIETY OF BRITISH GAS INDUSTRIES.—Council meeting in the afternoon.

Jan. 18.—YORKSHIRE JUNIOR GAS ASSOCIATION.—Meeting in Bradford. Paper by Dr. J. A. Sugden (Leeds University) on "Refractories."

Jan. 25.—SCOTTISH JUNIOR GAS ASSOCIATION (WESTERN DISTRICT).—Meeting in Glasgow. Paper by Mr. Alex. Tran, of Helensburgh, "Some Notes on Ferro-Concrete." Also, Mr. A. McFarlane will read his Thesis which gained the Diploma of the Institution of Gas Engineers.

Jan. 30.—MIDLAND JUNIOR GAS ASSOCIATION.—Meeting in Birmingham. Paper by Mr. C. Featherstone Hammond, of Messrs. Submerged Combustion, Ltd., on "Submerged Combustion."

Jan. 31.—LONDON AND SOUTHERN DISTRICT JUNIOR GAS ASSOCIATION.—Meeting at the Westminster Technical Institute. Paper by Mr. G. Percival on "Horizontal Retorts."

GAS STOCK AND SHARE MARKET.

[For Stock and Share List, see later page.]

APART from the natural diminution of business owing to the proximity of the Christmas Holidays, the further Hatry charges, followed by the Shipping and Paper disclosures, forced down prices on the Stock Exchange last week to even a lower level than has prevailed during the past few weeks, and business was practically at a standstill. Gilt-edged issues sagged, and even the sturdy War Loan was severely shaken. There have been a few individual cases of firming-up, and there is little doubt that opportunities exist for securing shares at attractive figures. Taking the various markets as a whole, however, depression rules the day, and there appears to be little prospect of any improvement in the immediate future.

The following transactions were recorded during the week:

MONDAY.—British 114, Commercial 91, 92½, European 13¼, Gas Light and Coke 17s. 10½d., 18s., 18s. 1½d., 18s. 3d., 4 p.c. pref. 75¾, Imperial Continental 335, Primitiva 28s. 9d., South Metropolitan 100, South Suburban 5 p.c. 107½, 5 p.c. deb. 94, Tottenham 104. Supplementary prices, Croydon 7½ p.c. pref. 102½, 103½, Torquay and Paignton 5 p.c. pref. 82½, 83, Uxbridge 5 p.c. deb. 90¾.

TUESDAY.—Alliance and Dublin 93½, 95½, Bournemouth "B" 12⅝, British 4 p.c. deb. 72¾, Commercial 91½, European £12 18s., 13, Gas Light and Coke 17s. 10½d., 18s. 3d., 3 p.c. deb. 59, Imperial Continental 335, South African 98s. 1½d., 100s., Tuscan 41s. 3d., 42s. 6d. Supplementary prices, Farnham additional 10½, 6 p.c. pref. 91½, Mid-Kent 76s. 3d., Tottenham 5 p.c. pref. 85.

WEDNESDAY.—Bournemouth 6 p.c. pref. 10¾, British 4 p.c. deb. 72, Colombo 34s. 3d., Commercial 92, European 13, 13⅛, Gas Light and Coke 17s. 10½d., 18s., 18s. 3d., 3½ p.c. 61½, 3 p.c. deb. 58, Imperial Continental 332, 335, 336, 337, 338, 3½ p.c. deb. 72, South Metropolitan 99⅛, 99⅝, 100, 100¼, 100½. Supplementary prices, Croydon 6 p.c. deb. 101, Liverpool 5 p.c. deb. 98.

THURSDAY.—Alliance and Dublin 93½, 95¾, Bristol 5 p.c. 85¼, British 114, 4 p.c. deb. 70 *ex* div., European 13¼, Gas Light and Coke 18s., 18s. 1½d., 18s. 3d., 4 p.c. pref. 75¾, 3 p.c. deb. £56 16s., 5 p.c. deb. 96½, 99½, South Suburban 5 p.c. 101½.

Money was in larger supply in Lombard Street than usual towards the end of the week; but the holding-up of money in connection with the Stock Exchange settlement caused a temporary rise in the loan rate to 4½ p.c., and renewals were mostly made at 4½ p.c. Discount rates were easier in tendency, but, at the time of writing, the Treasury Bill allotment has not been made.

On the Foreign Exchange Market business was inactive. The dollar was more favourable to sterling at 4.88⅞. French francs declined to 123.90; Belgas were dealt in at 34.86; and Italian lire at 93.25. Spanish pesetas declined to 35.35, but Dutch florins improved to 12.10⅛. German marks were quoted at 20.37¾.

Silver was lower owing to Chinese sales at 22 5/16d. per oz.; while Gold remained at the nominal rate of 84s. 11½d. per oz.

The Bank Rate is 5 p.c., to which it was reduced from 5½ p.c. on Dec. 12. The Banks' deposit rate is 3 p.c., and the deposit rates of the Discount Houses are 3 p.c. at call and 3¼ p.c. at notice.

PHYSICS IN RELATION TO THE UTILIZATION OF FUEL.

By Dr. C. H. LANDER, Director of Fuel Research.

[From a Lecture before the Institute of Physics, Nov. 27.]

Coal was commonly classified upon considerations of its volatile content, flaming characteristics, or ultimate chemical analysis, but scientific workers were gradually coming to realize the important bearing of the actual nature of the coal substance, including its physical structure, upon fuel problems. The aid of the microscope, for instance, had recently been widely enlisted both in the examination and classification of coal, and in the identification and correlation of coal seams. Two methods were now commonly employed—either a thin section might be prepared for examination by transmitted light, or a surface of the specimen might be polished and, if necessary, etched, for examination by reflected light.

The application of X-rays to the examination of the ash of coal, which was first suggested many years ago, had recently been developed in this country by Kemp, and was yielding useful results, the method depending upon the difference in transparency to X-rays of the organic coal substance and the inorganic ash constituents. From the results so far obtained, it seemed probable that with improved technique the method would provide a rapid means of determining the distribution, nature, and amount of the ash in coal, which had an important bearing upon problems of coal washing.

Attempts had also been made to gain further information on the structure of coal or coke by means of an X-ray spectrometer. This work apparently demonstrated the presence of graphite in each of the types of coke examined; moreover, when four widely different varieties of coke were investigated, a distinct parallelism was observed between the size of the graphite crystals as indicated by the shapes of the resultant reflection curves and the reactivity of the coke, as determined by the Fuel Research Station method; the most reactive coke apparently being made up of the smallest crystals, and *vice versa*.

Dr. Lander remarked that this work provided an interesting illustration of a physical method of attack upon the problem of coke structure which had yielded results in an unexpected direction and one not previously known; it was probable that physical methods would prove of assistance in unravelling this and allied problems which so far had not proved capable of a satisfactory solution on purely chemical lines.

PHYSICS OF THE FURNACE.

A comparatively undeveloped subject was the physics of the furnace. This was no doubt partly due to the complicated nature of the problems involved. From a physical point of view the problems were complicated chiefly because they involved the transfer of heat from a moving medium. In a completely enclosed furnace, such as the electric furnace, the problems were very much simplified. The fuel-fired furnace, however, was a much more difficult problem on account of the moving gases. It had been increasingly realized during recent years that radiation from furnace gases was probably a factor of great importance.

Those concerned with heat problems have cause to look with envy upon the results obtained in aeronautics through the medium of small-scale "model" experiments. There was no equivalent in heat to the wind tunnel in aerodynamical research. Mathematically this was primarily due to the much greater number of variable factors which entered into heat problems. Instead of one Reynold's number as in aeronautics, the heat physicist was faced with several "criteria," which in fact it might be impossible to satisfy concurrently; model experiments so designed as to yield information which could be directly correlated with full-scale working were therefore, in general, not feasible where heat flow was concerned. In any type of fuel-fired furnace, for instance, in addition to the flow of the combustion gases, heat interchange by conduction, forced and natural convection, and radiation were taking place. These together produced conditions of such complexity that the heat engineer or physicist was nearly always forced to conduct his experiments on the full scale, involving not only greater expense, time, and labour, but also greatly increased difficulty in controlling working conditions, and in interpreting the results obtained. Experimenters had indeed been accustomed to express their results in empirical formulæ which went no further than fitting the limited range of conditions covered. The disadvantage of such a procedure was obvious, since it precluded the application of the results to conditions differing even only slightly from those of the test, and rendered comparison with the work of other investigators extremely difficult, if not altogether impossible.

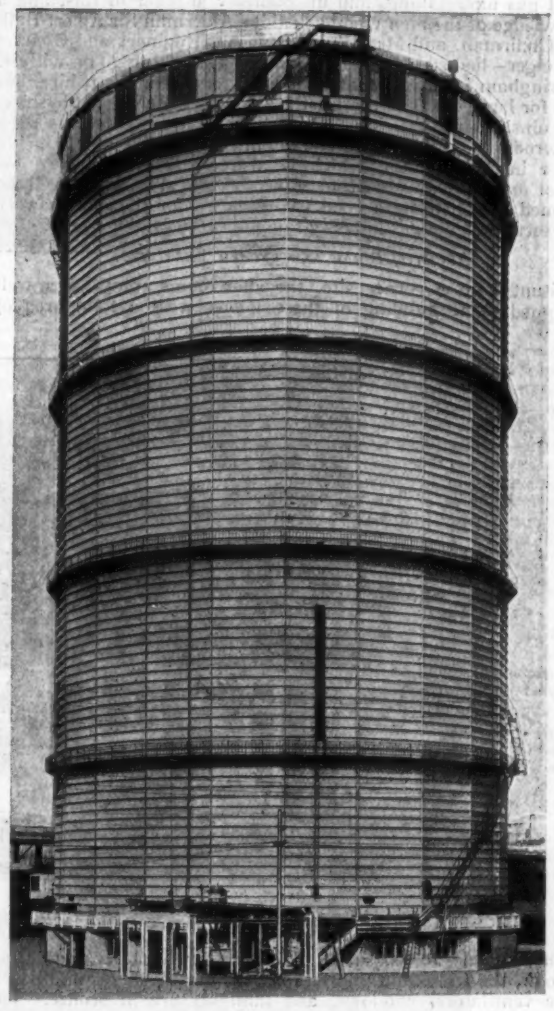
Despite the great complexity of industrial heat problems, the analytical methods of attack upon which pure physics had been built up, though sometimes difficult to apply, led further than empirical ones, since they assisted in a wider and fuller understanding of the fundamental principles involved, which should in time tend to a more rational design of furnaces or other heating appliances.

VANCOUVER'S WATERLESS HOLDER.

Aluminium Painted.

Vancouver's new waterless gasholder, owned by the British Columbia Electric Railway Company, is now taking on a luminous glow. For weeks past painters have been at work on this new tall landmark of the city, and when they have finished the holder will be visible from all sides for many miles around when the sun is shining on it. The work of painting the gasholder is being done by the B.C. Decorators and Sprayers, Ltd., of Vancouver, B.C., and is costing in the region of $2500.

As soon as the $300,000 holder with its capacity of 3 million c.ft. was completed, the painters commenced their work. A priming coat of flat grey paint was applied. When work had progressed halfway up the holder the painters' union demanded that an advance of 50 cents be paid the men for altitude work, and, this being agreed, painting proceeded.



Waterless Holder of the British Columbia Electric Company at Vancouver. Erected by Robert Dempster & Sons, Ltd., of Elland.

Now a coat of shining aluminium paint is being applied to the holder. The paint is supplied by the Ayers Varnish Company, and it is estimated that 200 gallons of paint will be required. The painting is being done entirely by spraying machines.

When the painting has been completed, sign painters will start operations. The words "Gas, The Modern Fuel," will be painted in 20-ft. letters on the sides of the holder. This wording will be repeated three times so that it encircles the entire holder. The words "Gas" will be illuminated with neon tubing, while floodlights will be played on the balance of the painted sign.

Royal Sanitary Institute Congress.—The Right Hon. Lord Cornwallis, C.B.E., T.D., J.P., D.L., Chairman of the Kent County Council, has consented to act as President of the 41st Congress and Health Exhibition of the Royal Sanitary Institute to be held at Margate from June 21 to 28, 1930.

ENTERPRISE IN THE MIDLANDS.

Municipal and Private Traders Pull Together.

This week's showroom opening (we might almost say) was at Nottingham—and nothing gives us greater pleasure than to note the present rate of advance of this excellent movement, which is doing so much for the gas industry on the sales side. But there were several features of exceptional interest in connection with the opening of a Radiation showroom last Wednesday. We believe it is the first instance in which the firm have built and staffed a showroom entirely on their own account in the Provinces. Naturally such an enterprise could have little hope of success without the hearty co-operation of the local gas undertaking, and undoubtedly an offer of this, and a knowledge of the men who backed it—Alderman Sir Albert Ball, the Chairman, and Mr. John Wilkinson, Engineer and General Manager—had suggested to Radiation Limited to go on with it. Nottingham itself is a centre not only for Nottinghamshire, but also for large tracts of the East Midlands, including Derbyshire, Lincolnshire, and Leicestershire. So that the opening of a showroom on entirely up-to-date lines near the new Market Place in Nottingham, which is also a converging place for motor omnibus routes from a very wide area, may well be claimed to constitute a good step forward for the already very live section of the gas industry known as the Midland area.

ARCHITECTURAL AND OTHER FEATURES.

Situated on a corner site, the showrooms comprise a well designed stone building of three floors, with a total area of approximately 10,000 sq. ft. The exterior front is carried out in oak, the frieze and pilasters having moulded caps and bases. The ventilators, windows, and fanlights are in bronze. The entrance is in semi-circular form, with wide steps and revolving doors. Full use is made of basement, ground floor, and first floor for a well considered display of apparatus.

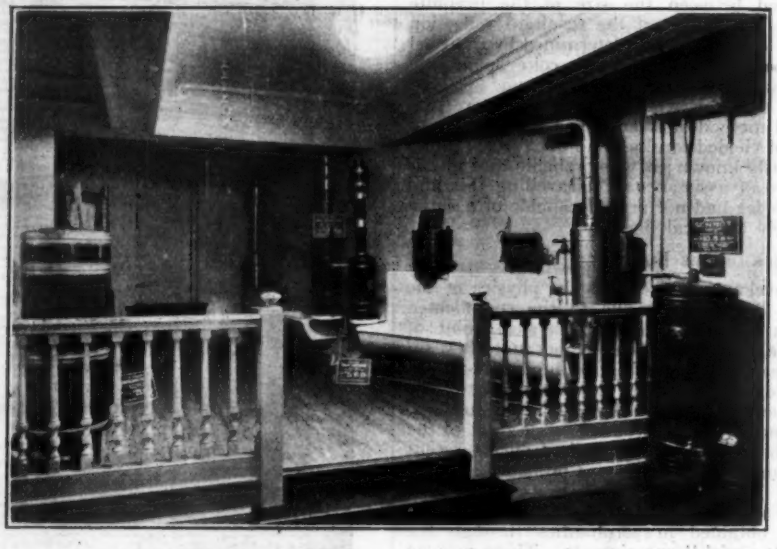
The ground-floor scheme is Georgian in treatment, with medallion-enriched cornice and beams, supported by Ionic columns and pilasters. The walls between are panelled with mouldings. The colour scheme is a painted and stippled Georgian green. A feature is made of a large fire-place opening, which is Dutch-tiled, for the display of cooking ranges. In the windows facing the thoroughfares are two fine-tiled "interiors," each of which displays two types of gas fire. The fitments are transportable and allow for changes in the display. The heating is by gas radiators, and the lighting system employs the latest type of ventilating lights which assist in the air change of the room. This showroom is to be used mainly for the display of domestic cooking and heating appliances. A full range of Radiation gas fires with "Beam" radiants in their numerous pleasing designs and finishes is to be seen on this floor, and a representative selection of Regulo-Controlled "New World" cookers, which the Nottingham Gas Department have adopted for offer to their consumers on very favourable terms. Office accommodation is also provided on this floor, where consumers may pay their gas accounts, and obtain information respecting all the details of the service which the Gas Department provides.

The basement and first floor showrooms are approached by fine staircases of oak with moulded balusters and hand-rails. The basement has a scheme of plain and severe style, the moulded cornice and beams being supported on Doric columns and pilasters, with French grey as the decorative tone. There are two tiled fire-place openings for the display of hotel cooking apparatus here, and the whole of this showroom is devoted to the display of large cooking apparatus, with a space for geysers and hot-water appliances.

The first floor follows the Georgian tradition in decorative treatment. The cornice is supported by Doric piers and pilasters, and the walls are finished in a delicate shade of parchment, rolled and stippled, and there are specially-designed surrounds and mantles, arranged so that "live" gas fires may be exhibited. Office accommodation is provided at one end of this showroom, and at the other there is a moveable platform for use when cookery demonstrations are given, for which this fine showroom is ideally suited. Town hall ventilating lamps are used in this showroom, which is also heated by gas radiators. Spacious bays have been formed in the walls for gas fires in tiled surrounds, and moveable fitments are available for gas mantel registers.

All the flues in the building, for ventilating lights, gas fires, and geysers, are built with Nautilus "Economy" flue blocks, which have enabled the fullest use to be made of the space available.

The interior decorations and fittings were designed and carried out by the Nautilus Company of Luton and Oxford Street, London (Radiation Ltd., Proprietors), who have achieved just that "something different" which makes all the difference.



WATER HEATING DEMONSTRATION.

The building was erected by Alderman Bowles, J.P., Building Contractor, of Nottingham, to the designs of Messrs. Bright & Thoms, Architects.

LUNCHEON.

Prior to the opening ceremony the Directors of Radiation Limited entertained the Lord Mayor and representative business men of Nottingham to luncheon at the Welbeck Hotel; Mr. H. M. Thornton, J.P., Chairman of Richmonds Gas Stove Company, in the Chair, in the unavoidable absence of Mr. H. James Yates.

After the Loyal Toast,

Alderman Sir ALBERT BALL, Chairman of the Nottingham Corporation Gas Committee, gave the toast of "The Lord Mayor," which was heartily pledged. In replying,

The Rt. Hon. the Lord Mayor, Councillor W. WESSON, observed that the gathering was due to the fact that municipal enterprise and private enterprise had agreed upon, and shown the way to, co-operation. The lion and the lamb had lain down side by side; but which was which he did not know. On taking office he had expressed the hope that the year would be one of progress; and if the present enterprise was going to aid the prosperity of the city, he would be satisfied.

NOTTINGHAM'S GAS RECORD.

Mr. H. M. THORNTON then proposed the health of the Gas Committee, and referred to statistics in the Nottingham Gas Centenary Brochure published in 1924. For over 55 years now the Municipality had owned the gas undertaking, which must be nearly a record; and wisdom must have been the lot of the Councillors in

HOTEL APPARATUS IN THE BASEMENT.

those far-off days, for since then the consumption of gas had grown steadily; and profits in proportion. Over 3000 million c.ft. of gas was now sold per annum; and there were more than 450 miles of mains. On the district there were 105,000 meters and over 100,000 pieces of apparatus. The Department had contributed in excess of £1,400,000 to the relief of the rates. All this was evidence of cautious and progressive management; and while Sir Albert Ball had put much care and thought into his conduct of the Department, he (Sir Albert) would be the first to give credit to Mr. John Wilkinson, the Engineer and General Manager, and others. In the case of the new Radiation showroom, Mr. Thornton pointed out, Sir Albert Ball, on being approached about a representative exhibition, had asked, "why not a permanent exhibition?" and after general negotiations, Radiation Limited had decided to co-operate with the Gas Department to develop the scheme.

To be No Funeral!

Sir Albert Ball regretted the absence, through sickness, of the Vice-Chairman of the Gas Committee, who would have replied to the toast; but he, Sir Albert, could assure them that the gas undertaking was the premier trading concern of the Corporation. It supplied the wants of the people; and it was the most profitable. For long the gas industry had been threatened with extinction, but he could assure them there was going to be no funeral—gas would live as long as Methuselah. Wisely managed and working together, gas and electricity undertakings could be of the greatest use to the community, and gas people did not grudge the successes of electricity; but they did at times resent the way in which Governments nursed their competitor to the exclusion of gas. If gas had been treated in the same way, its progress would have been even greater than it had been. As for the new showrooms, he looked upon them as about to serve the double purpose of a permanent exhibition and a contributor to the rates, so that both Nottingham and Radiation Ltd. were going to get something out of the enterprise. Nottingham was the shopping centre for many important towns.

Not Found Wanting.

Alderman Herbert Bowles, J.P., proposing "Success to the Gas Industry," remarked that for 116 years gas undertakngs had been tried and had not been found wanting; and he believed they were now rendering better service to the community than ever before. That 95 p.ct. of the population enjoyed the products of the gas industry was a pleasure for gas men to realize; but it was a great responsibility. Radiation Ltd. were prepared to show Nottingham the best that gas could do; and alongside were the Electricity

THE GROUND FLOOR SHOWROOM.

Committee, showing the best that electricity could do. He for one wanted to see the Departments kept separate.

A PLEA FOR FREEDOM.

Mr. J. FERGUSON BELL (ex-Lord Mayor of Derby, Director and General Manager of the Derby Gas Light and Coke Company, and Past-President of the Institution of Gas Engineers), replying to the toast, claimed, on behalf of the gas industry, a fair field and no favour; and he once more called attention to the disposition of the Government to pamper the electricity industry at the expense of the gas industry. Quoting from the last Board of Trade Returns, Mr. Bell remarked that 774 authorized gas undertakings had last year used 17¼ million tons of coal, which was 3¾ million tons more than seven years ago. Further, they had consumed 56 million gallons of oil and 7 million tons of coke. Their purchases of coke oven gas for distribution had amounted to 6650 million c.ft. In the latter regard, the speaker referred to the Committee on Area Gas Supply, which was at work, and expressed the hope that the result of that inquiry would be that the gas industry would be tied in no way either to the coke ovens or to the collieries. The gas industry alone had worked up to the present position as far as taking coke oven gas was concerned; and this year it would probably take more than double the previous amount. This was proof that compulsion was not necessary.

The company then adjourned to the new showrooms.

THE FORMAL OPENING.

The merits of the first floor showroom as a lecture room were demonstrated when, after luncheon, a large company were comfortably seated for the opening ceremony. Sir Albert Ball, in the Chair, introduced

The LORD MAYOR, who said it was a pleasure to him, as well as a privilege, to inaugurate formally this enterprise. He prophesied even greater "wonder and amazement" when the citizens of Nottingham saw the showrooms than had been attributed to them by the historian Bailey when they assembled in large crowds in the year 1819 to see the city's first efforts at public lighting by gas.

Mr. CYRIL DAVIS, Managing Director of the Davis Gas Stove Company, Ltd., in thanking the Lord Mayor, referred to the blessings which gas, under such able management, was conferring upon the citizens of Nottingham. He recalled the age-old advice to "feed the brute," but it was no use feeding him with bad cooking. Modern gas cookers, such as were displayed there, eliminated any risk of this, and almost any need for skill or training in the art. He emphasized the importance of efficient ventilation in conjunction with heating apparatus, which was scientifically provided by the latest types of gas fire.

Mr. J. F. DAVIES, Managing Director of Messrs. John Wright & Co., thanked Alderman Sir Albert Ball for his enthusiastic participation in the proceedings, and a hearty vote of thanks was accorded him.

The company were afterwards entertained to tea, and an inspection of the premises followed.

EVOLUTION OF THE CONTINUOUS VERTICAL RETORT.

By Sir ARTHUR DUCKHAM, K.C.B., M.Inst.C.E.

[From a Paper before the World Power Conference, Sectional Meeting, Tokyo, 1929.]

The past few years have seen many important advances in the design of gas-works equipment, but in no direction has this been more noticeable than in the construction and design of carbonizing plant.

In a period of considerable development it will probably not be disputed that the outstanding feature in gas engineering during the past two decades has been the rise to a position of predominance of the process of gas production in continuously operating vertical retorts. Twenty years ago, continuous carbonization was in an experimental stage; to-day, it is computed that over 50 p.ct. of the coal carbonized in British gas-works is dealt with in continuous vertical retorts, and this same method of carbonization has received world-wide adoption.

At the time when I was asked to present this paper at the World Power Conference meetings here, the Tokyo Gas Company had just decided to erect a large installation of the continuous vertical retorts of the type with which I have been associated since its inception in 1903.

To-day there are a number of successful systems of continuous carbonization, but in order that all through my paper I shall be dealing with information on which I have first hand knowledge, I propose to confine my remarks to the process known as "the Woodall-Duckham System."

At the present day a gas engineer, faced with the problem of increasing his carbonizing plant, has before him a number of different systems from which to make his choice. The four main types of carbonizing plant used in gas-works to-day are, probably, continuous vertical retorts, horizontal retorts, intermittent vertical chambers, and coke ovens. A study of the technical literature brings out the fact that all four systems have undergone striking developments during the past ten years.

Continuous vertical retorts, by improvements in design and methods of construction, can give larger outputs of gas per square foot of ground space, higher yields of gas per ton of coal, and lower fuel consumption than the plant of five years ago. Horizontal retorts, with a development of silica construction, improved charging machinery, and larger charges, can show lower cost of gas production than a few years ago. Intermittent vertical chambers, which are a natural development from the Dessau intermittent retorts, are making rapid progress, by reason of their high thermal output per ton of coal, high output per square foot of ground space, and low maintenance costs. Coke oven construction has been fundamentally altered by the development of the large silica quick-coking ovens with the necessary adjunct of even heating.

With four progressive systems of carbonizing plant it would appear, at first sight, that a gas engineer is faced with four equally suitable propositions. If, however, a census was to be taken of the extensions to the carbonizing plants of gas-works in Great Britain during the past five years, it would be found that over 95 p.ct. were in the form of either continuous vertical or horizontal retorts. It is suggested that in the past there has been too great a tendency for fashions in carbonizing plants, whereas, the fact of the matter is that in every individual case of reconstruction or extension the best type of plant should be considered afresh.

For any particular scheme it will usually be found that one particular type of plant is most suitable to meet the local requirements.

FOUR MAIN TYPES USED IN GAS-WORKS.

Before passing on to the main subject of my paper, it may be of interest to review the characteristics and applications of the four main types of carbonizing plant available for modern gas-works.

Dealing first with coke ovens, the economics of operation of a coke oven plant depends to a large extent on size. The modern quick-coking oven has a high output per day. A battery comprising a small number of ovens has to bear an excessive capital charge in the pushing and charging machinery. Coke ovens have less flexibility as regards output and calorific value than the other forms of plant. Therefore, except in the case of large undertakings which can ensure the continuous operation of a reasonably sized battery of ovens at full load, and which are sure of their disposal of coke, coke ovens do not come within the usual consideration for gas-works extensions.

In the large majority of extensions of carbonizing plant, there would appear to be three main systems to be considered—horizontal retorts, continuous vertical retorts, and intermittent vertical chambers. With modern machine-charged horizontal retorts, the labour costs are closely similar to those of both continuous vertical retorts and intermittent vertical chambers. But without machine charging, horizontal retort carbonization has a much greater labour charge. Even with a very small unit of continuous vertical retorts, the charging and discharging devices are the same as for a large plant; but with a small unit of horizontal retorts the charging machinery becomes a proportionately greater item of capital expenditure. Thus, with a small installation of horizontal retorts, one is faced with either high capital or high labour charges per ton of coal treated.

The output of gas per square foot of ground space—an important factor in these days of increasing demand for gas—is greatest with continuous vertical retorts, closely followed by intermittent vertical chambers and then by machine-charged horizontals. Modern continuous vertical retorts can produce nearly three times as much gas per unit of ground space as modern machine-charged horizontal retorts.

ADVANTAGES OF CONTINUOUS VERTICAL RETORT.

From the point of view of heat conservation, the advantage appears to be in favour of continuous vertical retorts over either intermittent vertical chambers or horizontal retorts for the following reasons:

(1) In both intermittent vertical chambers and in horizontal retorts, the coke is discharged from the chamber or retort red hot, while the coke from continuous vertical retorts is discharged cool.

(2) In both intermittent vertical chambers and in horizontal retorts, the offtake temperatures of gas leaving the retorts are higher than from continuous vertical retorts.

Further, with the introduction of the therm basis in Great Britain, there is a greater tendency to supply a mixed gas. There are two ways of doing this, by making straight gas in the carbonizing plant and mixing it with blue water gas made in an external generator, or by steaming the charge in the

carbonizing unit. Horizontal retorts do not lend themselves to steaming, but either continuous vertical retorts or intermittent vertical chambers can be operated to make gas over a wide range of calorific value, with an average gas-making coal. The economic limits with intermittent vertical chambers are approximately 560-470 B.Th.U. per c.ft.; with continuous verticals the limits are 550-400 B.Th.U. per c.ft.; but between these two systems there is an important difference. When steaming an intermittent chamber, the output of gas per hour is appreciably less than when making straight coal gas, but with a continuous vertical retort the output remains constant or even slightly increases. Thus, for a given daily output of gas with intermittent vertical chambers, the lower the calorific value of the gas to be made, the greater the capital cost per 1000 c.ft. With continuous vertical retorts, when a gas of lower calorific value is to be made there is no marked difference in the capital cost per 1000 c.ft.

In the case of an undertaking where the calorific value is already established, suitability of the plant for producing gas of the required quality is of great importance. Thus for calorific values above 520 B.Th.U. per c.ft., horizontal retorts or intermittent vertical chambers with low steaming are especially applicable. For calorific values from 520 to 470 B.Th.U., intermittent vertical chambers or continuous vertical retorts are suitable, with the balance progressively in favour of continuous vertical retorts as the calorific value falls to 470 B.Th.U. Below 470 B.Th.U. the continuous vertical retort is the most efficient plant.

Output of Gas Per Square Foot of Ground Space.

It was appreciated from early days that one of the great advantages of continuous vertical retorts was the large output of gas obtainable per square foot of ground space occupied. Of all the forms of carbonizing plant, continuous verticals give the largest output, and in this direction striking developments have been made within the past few years.

In the accompanying table, it will be seen that in a typical installation of "W.-D." continuous vertical retorts in 1914, the ground space occupied per ton of coal carbonized per twenty-four hours was 41·4 sq. ft., this giving, under average conditions of gas production, with a yield of 15,600 c.ft. of 500 B.Th.U. gas per ton, an output of 377 c.ft. of gas per square foot of ground space per twenty-four hours. In an installation being built during the present year, the ground space occupied per ton of coal carbonized per twenty-four hours is slightly less than half that of the 1914 installation; or, in other words, the output of gas per square foot of ground space has been doubled. In comparison with old hand-charged stop-end horizontal retorts of twenty years ago, the modern vertical retort installation can produce nearly eight times as much gas per square foot of ground space occupied.

Ground Space Occupied by Three Typical Installations of "W.-D." Continuous Vertical Retorts.

Installation.	Year.	Capacity Tons per 24 Hours.	Ground Space Occupied Sq.Ft.	Sq.Ft. Ground Space per Ton Carbonized per 24 Hours.	C.Ft. Gas* (500 B.Th.U.) per Sq.Ft. Ground Space per 24 Hours.
A	1914	120	4,970	41·4	377
B	1925	512	13,420	26·2	595
C	1927	695	14,232	20·5	761

* Based on an average yield of 15,600 c.ft. per ton.

Refractory Materials.

In the early days continuous vertical retorts were built of fireclay. At the present time all the retort faces and combustion chambers are constructed of best quality silica material, and this has enabled higher temperatures to be carried in the combustion chambers, with the result that the output per retort per day has been considerably increased. Broadly speaking, it may be stated that the use of silica and the subsequent carrying of higher temperatures has, in itself, caused a 50 p.ct. increase in the output per retort over the old fireclay types.

Heat Conservation.

The modern continuous vertical retort installation is highly efficient from the thermal point of view. In the old days heat conservation was aimed at by the construction of recuperative settings. In the latest type of plants, the settings are of the non-recuperative type, the heat from the waste gases being used for the production of steam in waste-heat boilers. In the old recuperative type of setting, it was possible to raise approximately 800 lbs. of steam in waste-heat boilers per ton of coal carbonized. In the modern non-recuperative settings, it is possible to produce as much as 1500 lbs. of steam per ton of coal carbonized, thus providing an ample supply of steam for operating the producers, steaming the retorts, and working the auxiliary plants. By the elimination of recuperators, it has been possible to close up the centres of the retorts, with the result that a larger output of gas is obtained per unit of ground space.

Another factor which has contributed to the improved thermal efficiency with continuous carbonization has been the development of the process of steaming, in which the heat from the coke at the bottom of the retort is utilized in the production of water gas within the retort. This has had the effect both of increasing the thermal efficiency of the process and also of materially increasing the thermal yield of gas per ton of coal. Heat conservation has also been effected by attention to heat insulation.

High Yield of Gas Per Ton of Coal.

Though continuous vertical retorts were developed mainly as a carbonizing system, yet they have been found to have certain other striking advantages. At the present time, in most parts of the world, there is a tendency to supply a mixture of coal gas and water gas for town purposes. There are two ways of making such a mixture, either by the production of water gas from coke in separate water gas generators and mixing it with straight gas, or alternatively, by producing mixed gas in a one-stage process. It is for this latter process that the continuous vertical retort is peculiarly suitable. By the introduction of steam at the base of the retort, water gas is produced which, passing up the retort, mixes with the coal gas which is being evolved from the coal in the upper parts of the retort, and a regular output of mixed gas per retort is thus obtained. By this method the coal, which in straight carbonization would only be capable of producing (say) 12,000 c.ft. of gas with a calorific value of 560 B.Th.U. per c.ft., can produce over 20,000 c.ft. per ton of 450 B.Th.U. gas.

Efficient steaming has been made possible by the adoption of silica construction, by increasing the heats in the lower portions of the retort, and by studying the problem of steam distribution into the retorts.

In order to illustrate recent developments in continuous vertical retorts, I now propose to describe the Tokyo plant.

The Tokyo Plant.

The new installation consists of two benches, each containing 22 103-in. retorts and is capable of carbonizing 440 tons of coal per diem, each bench being heated by means of five producers built in an independent battery at floor level away from the retort bench, but connected thereto by means of a common producer gas main. The waste gases from each battery of retorts are collected in a collecting main and pass to a waste-heat boiler, a separate boiler being provided for each bench.

The retort benches are of the non-recuperative type, and thus the waste gases pass to the waste-heat boilers at high temperatures.

Each retort is under independent control, being provided with its own producer gas, secondary air, and waste-gas flue dampers, and thus forms a complete heating unit. The retort faces and the combustion chambers are built of first-class silica brick for the full depth of the combustion chambers. Means of varying the temperature at the top and bottom of the combustion chambers and additional secondary air inlets, controlled by separate dampers, are provided. Both the side walls and the top of the bench are faced with hollow blocks packed with slag wool. Outside these blocks on the side walls for some distance down is laid a thick coating of insulating material to reduce heat loss through radiation to a minimum. From each retort a 9-in. offtake pipe passes up one end of the retort mouthpiece into a very ample collecting main common to the retorts on one side of each bench, there being thus four collecting mains. A drop valve of the mushroom type is provided on the inlet to the main with a cleaning door opposite the sloping section of the pipe.

The Producers.

In order to obtain satisfactory heating of the retorts, a regular supply of good quality producer gas is essential, and the closest attention has been paid to the design of the producers. The producer gas for each bench is made in a battery of five step-grate producers. Ample grate area is provided, and the producers are fitted with doors so that they may be worked under pressure, and the heats in the settings maintained even in the event of inferior fuel being used. The producer gas is led by uptake pipes into a common distributing main which extends the whole length of the retort bench, and is built up of mild-steel plates lined with 7½ in. of insulating material. A rectangular header leads the producer gas from this main into every pair of retorts.

When we had completed, in 1905, our third experimental plant, we began to feel that if we had a little more experience we should know practically all there was to know about continuous carbonization, but, as each plant was built, new features came to light, and now, having built well over 200 plants, we still feel that there is a lot to learn. But it is only by practice, by experiment, and by research, by both our clients and ourselves, that we have been able to develop continuous carbonization to its present state of high efficiency, and I feel that, though we do not claim perfection and are always striving to improve, we can look back with proper satisfaction to the progress that has been made since those days in 1903 when the Woodall-Duckham process was in its infancy.

Our mottoes throughout have been simplicity in construction and operation, ample strength and stability to meet all needs, combined with the best workmanship and material procurable.

REVIEW OF REINFORCED CONCRETE.

By Eric O. Rose, B.Sc., Assoc.M.Inst.C.E., Assoc.M.Inst. Gas E.

Though the first patents for the reinforcement of concrete were taken out over seventy years ago, it was not until the first decade of this century that any extensive application of their principles was made to engineering structures, and it is only during the last ten years that engineers, architects, and the lay public as a whole, have begun to appreciate the wide possibilities that lie in the use of reinforced concrete. The slow progress in the earlier years, in this country in particular, can be attributed to a number of reasons, the most important of which is, perhaps, the economic one. With an abundant supply of steel, and the possible avenues of economy in reinforced concrete construction still unexplored, there was little incentive to rapid development in the adaptation of this method of construction to our needs; without a strong commercial stimulus, progress was, of necessity, slow. It was mainly the war that provided the opening. The neutral countries, more especially Holland and Denmark, found their supplies of imported steel sadly curtailed, and were forced to give their attention to the use of an alternative material. The extensive exploitation of reinforced concrete which followed is not, therefore, to be wondered at, nor the prominent part taken to-day by Dutch and Danish engineers as specialists in this material.

The Economic Aspect.

In considering the economic aspect of reinforced concrete, one of the most outstanding factors is the short period required for construction work in comparison with steel. The reason for this lies chiefly in the fact that no special work is required upon the materials before delivery, and that practically the whole can be obtained "*ex* stock," and work commenced without delay. Cement, sand, ballast, shingle, and timber can be obtained, in most districts, at a few hours' notice, and, if patented systems be avoided, reinforcing bars can be despatched from the mills within a very short time. If an immediate start is vitally necessary, sufficient steel to enable work to be commenced is always available from local stockholders at a slightly increased price, and actual construction work can be put in hand as soon as men and plant can be mobilized. With steel construction, on the other hand, considerable time is usually wasted, first in waiting for rollings of special sections, secondly in the double delivery from mills to shops and from shops to site, and again in delays in the constructional engineer's yard. No construction company can afford to keep a number of idle machines, and any sudden rush of work must either wait its turn or displace and delay other orders. The engineer who chooses reinforced concrete construction is freed from these hindrances and, furthermore, has the additional advantage of having the whole of the work under his personal supervision upon one site, thus being able to check delays which he would be unable to influence were the work being carried out in a contractor's workshops.

Rapid-Hardening Cements.

The development of rapid-hardening cements, too, has contributed much to the shortening of the time necessary for the construction of reinforced concrete works; concrete made with "Ferrocrete," for instance, can be fully loaded within four or five days of pouring, while piles containing "Ciment Fondu" will stand up to the most rigorous driving two days after casting. If an example of rapid construction be required, it is only necessary to consider the enormous buildings erected in so short a time for the British Empire Exhibition at Wembley. Such a feat could hardly have been accomplished in any other material.

Turning now to the gas industry, it is not until the last few years that reinforced concrete has come into extensive use. Gas engineers, realizing that, so far as reliability is concerned, 100 p.ct. efficiency is demanded from their plant, cannot lightly experiment with new materials. Doubts naturally arise as to the permanency of reinforced concrete, especially when submitted to the action of ammoniacal liquor. It was, indeed, well that too much faith was not placed in reinforced concrete in its early days, as the methods of construction then employed were not such as to guarantee perfect protection of the reinforcement. The experience of many years has led reinforced concrete engineers to give an ever-increasing consideration to the materials employed and the methods of mixing. Cements have steadily improved, while aggregates are now carefully graded and the water content is accurately regulated to give the most satisfactory concrete for any particular service. The result is a material which, when applied under proper supervision, can be depended upon for uniformity of strength and durability to the same degree as structural steel. The non-porosity of concrete has been proved by its frequent application to tar, liquor, and water tanks, while its gas-tight properties have been demonstrated by the many purifier installations erected of late. Its wide application for the construction of fuel storage hoppers witnesses to its durability under the abrasive action of coal and coke.

One of the main deterrents to the greater use of reinforced concrete in gas-works is the air of mystery that surrounds the specialist in this material. Only the largest gas undertakings are able to support a fully trained man to deal with this work, and engineers who have not had previous experience in the matter are rightly loath to set forth in a new field without the aid of expert advice. The general theory of reinforced concrete design is now taught in many technical colleges, and there are many text-books dealing with the subject, but such knowledge as may be gained therefrom is barely sufficient qualification to enable one to carry out design and construction work on the best and most economical lines. The majority of gas engineers are, therefore, compelled to seek the assistance of the specialist engineer when a reinforced concrete work of any magnitude is to be undertaken.

Specialists in Concrete.

Specialists differ somewhat in their scope, but they may be broadly classified in four groups, thus:

(*a*) The consulting engineer proper.

(*b*) The engineer who is prepared to submit competitive designs and issue specifications to contractors, on the understanding that no fee is payable if his proposals are rejected.

(*c*) The proprietor of a patented system of reinforcement or construction who is prepared to submit competitive designs and issue specifications to contractors, the patented material being supplied by himself and no fee being payable if his proposals are rejected.

(*d*) The engineer who is prepared to submit competitive designs together with a tender for the execution of the work, the same being carried out by himself and no fee being payable if his proposals are rejected.

It may be argued that the preparation of a number of competitive designs for one piece of work is not economical in the long run, as each job has to bear a share of the cost of previous unsuccessful proposals. Though wastage must take place in this respect, it is more than outweighed by the advantages which result. Competitive designers, keeping their information in the most concise and accessible form, need to spend but little time in the preparation of preliminary designs or estimates, while the ingenuity displayed by many of them in reducing the cost of construction is truly remarkable.

When it is realized that reinforced concrete is by nature a material fundamentally different from structural steel, it will be seen where the specialist designer has the advantage over the engineer who has been accustomed to working with steel only. It must be remembered that reinforced concrete is to be regarded as a monolithic material capable of sustaining stresses, if suitably reinforced, in any direction whatsoever. Such an attitude is not taken to steel construction, where a structure is considered as being composed solely of an arrangement of simple beams, ties, and struts. The earlier concrete designs were naturally devised in imitation of existing steel practice, and were limited to a composition of slabs subjected to a bending moment in one direction only—beams, tee-beams, columns, &c. The L.C.C. regulations of 1922 fairly well cover all that was considered safe and reliable in those days, but the broader outlook, breaking away from accepted "steel-work" principles, has since opened up much wider possibilities of construction. Attention to the design of floor slabs led first to the development of the slab reinforced in both directions and supported upon all four sides (this being more economical in many cases than the recognized system of tee-beams), and later to the slab of uniform thickness supported on columns only, without the use of main or secondary beams (the columns being increased in size immediately under the slab, to allow for the greater forces at these points). The use of influence lines has provided an accurate and rapid method of determining the bending moments on continuous beams under complex systems of loading, and the acceptance of the "steel beam" theory has considerably reduced construction costs by the elimination of the haunches to continuous beams adjacent to the columns.

Provision of Shuttering.

One of the most expensive items in reinforced concrete construction is the provision of shuttering, and the responsibility for reducing this charge lies not only upon the engineer in charge of construction, but upon the designer. It is in the drawing office that complex beam systems can be avoided and

the sizes of members standardized so as to permit of the re-use of formwork from one member to another, and even from one job to the next. Many engineers set out the whole of the shuttering and supporting timbering in the drawing office prior to commencement of the work; and it is apparent that in such cases the saving in timber and labour more than justifies the expense involved in the office. Standardized steel forms show marked saving on some classes of work, but, as pressed steel plates are liable to get severely battered in handling, the appearance of the concrete work is apt to suffer if the damaged plates are not frequently renewed.

For many types of structure, pre-cast concrete is found to be cheaper than pouring *in situ*. Retaining walls and similar pieces of work are often built entirely of pre-cast piles and slabs, manufactured on the site and handled into position. If rapid-hardening cement is used, the moulds are only required for a few days for each cast, considerable expense being saved in shuttering. In addition, no supporting timber work is needed, as the moulds are laid flat upon the ground.

One of the most important points to be attended to in the production of first-class reinforced concrete work is the supervision of the construction work on site. It is not sufficient to leave this to the care of the ordinary builder's foreman. Nearly all the possible causes of failure lie in the workmanship upon the site. The use of wrong aggregates, insufficient or improper mixing, the misplacement of reinforcement, and the neglect of concrete after pouring in frosty or in hot weather—all are matters which can only be avoided by placing the supervision of the work in the hands of a competent man who thoroughly understands the nature of the materials with which he is dealing and the principles upon which the structure is designed.

Architectural Aspect.

Finally, the architectural aspect of reinforced concrete engineering deserves mention. There is a certain school of architectural thought which finds expression in the description of every reinforced concrete building as a "whited sepulchre." Many architects have spent so much of their lives in the study of classical or Gothic styles that they are unable to perceive that the use of a new material dictates the introduction of a new style of architecture. There are some who still regard concrete in the same manner as they do the steel of a steel-framed building, and endeavour to ornament a structure with mouldings and cornices in the same manner that the engineering structures of the last century were often decorated with ornamental cast iron. It is the particular properties of a material that determine the manner in which it shall be employed; and only when the mind has co-ordinated these properties can a style of architecture be fully appreciated. Thus a massive building, the bottom storey of which is composed entirely of plate glass, is architecturally unsound, because everybody knows that the plate glass windows cannot possibly support the structure above. If, however, it were generally accepted that thin sheets of glass were more efficient struts than the heaviest granite facings, such a building would not appear incongruous. In the same way reinforced concrete architecture cannot be fully accepted until the public has gathered some idea of the nature of the material. To the untutored eye, many of the concrete arch bridges erected in this and other countries appear weak and flimsy, a comparison being made with the familiar heavier stone structures; but when a sense of the material is assimilated, the perfect poise of the arch is appreciated, and the beauty of the architecture stands out without the need of any decorative embellishment.

GAS IN TOKYO.

By KOJI GOTOH, Secretary of the Institute for Municipal Research

[From a Paper before the World Power Conference, Sectional Meeting, Tokyo, 1929.]

Prior to the Meiji era, or before the seventh decade of the 19th century, candles framed with paper called "Andon" were chiefly used. In 1872, gas was supplied in Yokohama for the first time in Japan. This was followed by other large cities supplying gas for homes. In the early days very few homes used gas for lighting, and, for this purpose, petroleum lamps were employed most extensively. The use of gas for lighting, however, increased steadily year by year, until in 1914 the total number of consumers throughout the country was 642,670 (of which 251,245 homes were in Tokyo); gas jets for lighting numbered 1,540,369 (of which 640,338 jets were in Tokyo). At the present time gas plays the most important part in heat provided for cooking, but its use for lighting has diminished to such an extent that it is now only serving, in some cases, as a reserve to replace electric lights in an emergency, or as street lights.

The use of gas is limited principally to cities, and is not extended to country towns. There are 953,688 households (of which 222,324 are in Tokyo) using gas, in which 2,235,080 jets are provided. The average monthly consumption during the year 1927 was 46·4 cub.m., of which 9·3 cub.m. was for industrial purposes.

Status of Gas Supply.

While the Tokyo Gas Company, Ltd., has a franchise, its business was originated, in December, 1874, by the Tokyo Kaigisho, followed then by semi-official supervision by the Chamber of Commerce, which supplied gas for street lights. It was not until October, 1885, that the present Company took over that business.

According to the statistical figures, at the end of November, 1928, the Tokyo Gas Company was supplying gas to the City of Tokyo and its surrounding six counties, and also to some parts of Kanagawa and Saitama Prefectures. Of the 446,360 households using gas, 265,926 were in Tokyo; 1,117,916 jets were installed. The Company's producing capacity was then 1,228,870 cub.m. per 24 hours; and its gasholder held 826,800 cub.m. This Company is the largest of its kind in Japan, being capitalized at 100,000,000 yen. It is planning to increase its capital to 200,000,000 yen, and to increase its total number of customers to 600,000, covering almost 65 p.ct. of the total number of households in Greater Tokyo.

The total number of households using gas in Tokyo is 265,926, as mentioned above, which corresponds to 59·6 p.ct. of the total number of 478,000 households in the city statistics of 1928. Gas supplied to the above number of households was 190,190,000 cub.m., which is 70·4 p.ct. of the total output of 270,260,000 cub.m. We find that during the year ended June, 1928, 86·8 p.ct. of the total output was consumed for domestic use, and 13·2 p.ct. for industrial purposes or otherwise. If this rate of increase in the number of consumers of gas is maintained in the City of Tokyo during the latter half of the year 1929, the monthly increase in the gas consumption will be about 18 p.ct.

It is evident that 80 p.ct. of the gas jets are for kitchen use, while 9 p.ct. are used for lamps provided for emergencies. The amount of gas employed for baths, stoves, boilers, and cooking ranges is very small, because these appliances are used by the upper class households or for certain business purposes.

Jets Classified by Apparatus Used by the Tokyo Gas Company.
[At the end of November, 1928.]

Kind of Apparatus.	No. of Jets.	Percentage.
Gas plates	901,516	80·6
Lamps	99,798	8·9
Bunsen burners	55,401	5·0
Stoves	31,961	2·9
Baths	16,798	1·5
Boilers	6,318	0·6
Cooking ranges	2,154	0·2
Special ovens	1,791	0·2
Automatic boilers	1,152	0·1
Furnaces	1,027	0·1

People up to the middle class usually go to public bath houses, the charge there per person being 5 sen. In 1927 in Tokyo the public bath houses numbered 1007, and in Greater Tokyo 2450.

The Tokyo Gas Company uses the low-pressure system. The declared calorific value of 1 cub.m. is 3600 cal., the pressure being 40 mm. water column. Uniform rates are used in the meter system. In Tokyo the rate is 7·95 sen per cub.m.; but in its suburban districts it is 8·5 sen. There is no minimum rate. For the use of a meter, 15 sen is charged per month for a single meter with a three-lamp capacity, and for five lamps or over an additional 5 sen per lamp. Customers are called upon to pay for any part of the pipe in excess of twelve metres measured from the joint of the pipe at the gas main.

Consumption of Gas.

The total amount of gas supplied throughout the entire country of Japan was 486,611,220 cub.m. in 1927, the figure being twice that of 1917. Taking the same period of time for comparison, 46·4 cub.m., the average monthly consumption per household in 1927 is 1·34 times as great. The above figures reveal that the number of small consumers has been increasing. In the year 1925, in Greater Tokyo the total number of homes was 904,386, with a total population of 4,108,916. In 1928, the total number of consumers was found to be 442,921; the average monthly consumption of a home being 57·7 cub.m.

Gas enterprise in the cities of Japan is still in course of development, and offers every possibility of becoming much more universal than at present; and in time to come the number of consumers of gas will probably equal that of electricity.

In connection with the future supply of gas in Tokyo and other large cities, the central heating systems may figure prominently. Such systems will consume a large amount of gas, replacing briquettes and other commodities used as fuel.

ACCURATE MEASUREMENT OF GAS FLOWS BY OTHER THAN VOLUMETRIC MEASUREMENT.

By JOHN L. HODGSON, of Messrs. George Kent, Ltd.

[Lecture before the London and Southern District Junior Gas Association, Dec. 13—Mr. F. S. Larkin in the Chair.]

Mr. Hodgson, who gave his address in the form of a lantern lecture—the meeting room being in darkness the whole time—said he proposed to give a short review of the twenty years' work he had done in endeavouring to measure gas and air and other fluids by methods other than volumetric standards. He first became interested in this work in the year 1908, in connection with the supply of compressed air from individual compressors to some fifty or sixty gold mines in the Witwatersrand. These compressors were run independently and were inefficient, as there was no centralized supervision. To indicate the magnitude of this particular problem, Mr. Hodgson stated that about 4 tons weight of compressed air had to be sent underground in order to raise 1 ton of gold ore to the surface, and that out of each ton of ore only a few ounces of gold were obtained. The value of the compressed air used on the Rand gold field was about £500,000 a year, and it occurred to Mr. A. M. Robeson, the Chief Engineer of the Eckstein Group, that if compressed air could be produced in a central station and distributed under efficient supervision, very large economies would be possible. One of the first points that arose, however, was the necessity for some accurate method of metering the compressed air; and in 1910 a sum of about £4000 was set aside for research by Messrs. Eckstein, which research was conducted by himself and his staff at Messrs. George Kent. As it was impossible to use a large drum type of station meter for metering this compressed air, it was part of his problem to devise accurate alternative methods. One of these was the venturi air meter.

The mechanism of this meter was illustrated by numerous lantern slides, and Mr. Hodgson stated that during the visit of the British Association to South Africa this year, the meters which he had installed on the Rand nearly twenty years ago were inspected and found to be still functioning with an accuracy of ± 2 p.ct.—an accuracy which was greater than that of the electricity meters which were used on the power distribution scheme by the Victoria Falls and Transvaal Power Company.

Continuing, Mr. Hodgson said that, having successfully carried out this work on the venturi meter in connection with the measurement of compressed air, he turned his attention to the bulk measurement of gas, and that in 1910 the first example of a venturi gas meter was installed at the Bromley Gas-Works. It was put in to deal with dirty gas, and, as the throat of the meter quickly became dirty owing to deposition of tar and naphthalene, a steam jacket was put round for heating purposes, to prevent this deposition. Trouble was also experienced at first with condensed moisture in the pressure pipes. As they were dealing with small differences of pressure, they could not allow any water to collect in these pipes. Sumps were therefore arranged at the lowest points, to drain the moisture off.

He had not been measuring gas very long, continued Mr. Hodgson, before he found the problem was altogether more difficult than the measurement of compressed air, because air had a constant density, and, though this density might vary with pressure, it varied in a known way. In the case of gas, however, the density varied according to the number of retorts, the time they had been on, the quality of the gas, &c. Eventually, however, he found it possible to devise venturi gas meters which automatically allowed for variations in the density of the gas, and a considerable number of such meters were now at work and giving satisfaction. In this type of meter, the expensive clock mechanism used in the original air measuring meters was dispensed with, and the density correction was attained by the use of a small wet gas meter. The whole instrument measured to an accuracy of about 1 p.ct. over a range of 1 : 10. (Diagrams and outside views of this type of instrument were shown.)

Though it took a long time to develop this type of meter, it soon became apparent that something cheaper and simpler was desirable. This was provided in the fan-shunt type of gas meter which had only one moving spindle and so only two bearings which might give trouble. In the latest of these meters, there was a magnetic drive, so that there was no friction in getting the motion through to the countertrain. The bottom bearing was placed under mercury and never gave any trouble. The top bearing, when dealing with dirty gas had, however, sometimes given trouble which had been got over by squirting paraffin at intervals into the bearing without opening-up the meter. These fan-shunt meters were an entire success with clean gas, and quite a number of them were running with success on dirty gas and on water gas plants. It was preferable to place the meters between the producer and the gasholder where the gas was hot, so that sticky tar did not settle in them.

Unlike the venturi type of meter, these fan-shunt meters would stand considerable overloads. They were also very suitable for measuring intermittent flows. They had a normal range of 1 : 10, and could be overloaded 100 p.ct. without damage. The mechanism was the same for all sizes of meter, and the meters *were in all cases exactly 2 ft. long*, whether required for a 6-in. main or a 40-in. main.

Mr. Hodgson then showed illustrations of his cylindrical pitot tip for measuring air, water, and gas flows, and stated that for many metering purposes it was preferable to the National Physical Laboratory type of pitot tip. It was more easily reproduced with accuracy, was more easily withdrawn from the main, and it produced nearly twice the pitot head. Even so, a pitot tube device could only be used when the *lowest* gas velocity to be measured exceeded 5 c.ft. per second. In connection with this type of instrument, Mr. Hodgson stated that inquiries were frequently received from gas engineers who thought that all they had to do was to bore a hole in the gas main and insert a pitot tube in order to measure the flow of gas. Gas flow measurement was unfortunately rarely so simple, as gas mains were usually large in diameter so as not to waste pressure, and very often the lowest velocities were much less than 5 c.ft. per second. Nevertheless, there were many cases in which the pitot tube instrument could be used with success. Mr. Hodgson next dealt with the theory of the square edged orifice bolted between two flanges in a pipeline, which he had introduced in 1910. He stated that there were now some 10,000 orifices in use measuring steam, air, gas, oil, and water flows.

The lecturer then referred to the Kent "self-cleaning" orifice meter which he had introduced some years ago, but concerning which he expressed disappointment that it had not been adopted on a larger scale. The self-cleaning orifice, he said, was the result of a problem put up to him by Mr. Stephen Lacey, of the Gas Light and Coke Company, in connection with the measurement of dirty gas, and as a result he had suggested to Mr. Lacey the use of orifices having a liquid injected at intervals so as to clean them. Perhaps during the discussion some information might be forthcoming with regard to these self-cleansing orifices.

Mr. Hodgson illustrated and described a number of other meters, mostly for measuring steam and air, and discussed the general theory of their construction. Included in these, however, was Kent's curved tube manometer for measuring gas to purifiers or to the districts, and for general purpose use on the gas-works. In conclusion, in the course of some general remarks on the economic advantages of accurate measurement, whether of steam, air, gas, oil, or other valuable industrial fluids, the lecturer mentioned that £120,000 a year had been saved to one group of gold mines by the more accurate measurement of the compressed air they used, and £1000 a month in the case of a large steel making plant; and he calculated that the instruments which he himself had been responsible for bringing into existence during the last twenty years were effecting a saving in the hands of those who used them of more than *£2,000,000 a year.*

Discussion.

The CHAIRMAN said that Mr. Hodgson had shown in a remarkable manner what economies could be made in the industrial world. When a saving of £120,000 a year could be effected in one plant alone, it made one shudder to think of the waste that was going on in other directions. Mr. Hodgson's description of his work had been extremely interesting, and it must be a lifelong satisfaction to him that he had been able to do, and was doing, so much for industry. He had had the opportunity of seeing the meter at the Bromley (Kent) Gas-Works which had been mentioned.

Mr. J. G. CLARK (Gas Light and Coke Company) remarked that the occasion on which the Chairman and himself had seen the Bromley meter was twenty years ago, when the Association visited the works; and it was interesting from the lecture to see the enormous amount of work that had been done since. At the time of that visit he had asked why the tube was not put in the vertical position, to allow any leakage to get away more easily; and it seemed now that Mr. Hodgson had found it more convenient to place the tube in the vertical, instead of in the horizontal, position. He wished it were possible to use meters of that type for supplying gas to consumers, at any rate to fairly large industrial consumers, because at present large and expensive meters were necessary, and they were not always easy to house. He did not know whether Mr. Hodgson held out any prospect of this means for measuring gas

which would be less expensive and more convenient than the ordinary type of gas meter now in use.

Mr. HODGSON said that the venturi tubes in these meters were now put vertically instead of horizontally for two reasons. The first was that the tar was better able to run down, and so caused far less trouble; and the second was that meters with the tubes vertical occupied much less ground-space. All the tubes in the later meters were vertical. As to the prospects of a compact meter of this type for consumers of gas, he had shown such a meter in one of his lantern slides—viz., the shunt gas meter. It was only 2 ft. long, and was far more compact than any other meter; the range was 1-10, and it would stand overloads of 100 p.ct. and, in addition, was extremely simple.

Mr. J. H. GOLDSMITH (South Suburban Gas Company) said that he had seen most of the meters of which they had been shown illustrations during the lecture, and they were all simple pieces of mechanism and worked exceedingly well. Unfortunately, it was not easy in the case of the pitot tube instruments to check their accuracy, but those that had come into his hands seemed very accurate. The shunt meter introduced by Messrs. Kent seemed to be a step in the right direction, and in use it appeared to behave very well. He had also had experience of the curved tube instrument, and could confirm the statement that it was possible to read the meniscus to a very fine degree of accuracy.

Mr. HODGSON said that the great feature of the shunt meter was that, instead of a large number of nozzles, as was the case with the previous types of rotary meter, there were only two nozzles. This gave the minimum amount of error due to clogging of the jets. In the Kent "fan-shunt," there was a shunt circuit and a main circuit, and the probability was that both circuits became blocked up in the same proportion, so that no error at all occurred for slight amounts of clogging. Another interesting point about the Kent "fan-shunt" meter was that it could be checked at any time while it was running. Another feature of these instruments was that they were extraordinarily cheap, as compared with the ordinary station meter. A 30-in. meter of this type cost about £360, and occupied only 2 ft. of pipeline, whereas an ordinary 30-in. station meter could scarcely be purchased and housed for ten times that sum.

Mr. F. C. HAWES (Tottenham and District Gas Company) said he had had a curious experience with orifice meters, and perhaps Mr. Hodgson could say something on the matter. They had wanted to put an orifice meter of the ordinary disc type into a foul gas stream where a great deal of condensation was expected, and it was impossible to position it anywhere except in a vertical main. The point had been raised with the makers (who were not Messrs. Kent) as to whether the condensate falling on the disc and cascading over it would cause trouble, and they said they thought it would be all right. The meter was therefore installed, but it had to be checked against the station meter to ensure satisfactory results. There were two instances of this kind, but, whereas in the first case the gas was flowing downwards, in the second case it was flowing upwards; and apparently in this latter case there was a turbulence set up which threw a mist of water and tar against the gas offtakes at which it was desired to measure the pressure. He was able to reproduce this condition in a glass tube. The only way it had been possible to use the meter in the second case was to put drain seals on the disc, and only use the meter intermittently for snap readings. The water partially condensed away from the disc through the seals, but it was not satisfactory by any means. The advisability of taking advantage of the pressure loss due to the disc also had been considered. Some of the pressure, of course, was recovered, but there was a definite permanent drop through the disc; and he had wondered whether, if pressure points were taken a long way away from the disc on either side, it would be possible to get a steady reading which, though it might not be correct on the meters, could be calibrated to give a correct reading.

Mr. HODGSON said it would be possible to take the pressures a considerable distance away (say, three diameters) on either side of the disc; and if Mr. Hawes would give him particulars, he would tell him the best position.

Mr. LEONARD LACEY (Gas Light and Coke Company) remarked that he had had some experience with the self-cleansing orifice, and noticed that Mr. Hodgson in his lecture had stated that paraffin was used as the cleansing medium. He, however, did not remember using paraffin; as a matter of fact, ammoniacal liquor was passed through the meter. He did not know if there was anybody now at Bromley-by-Bow who could say what happened to that self-cleansing orifice, but he believed it had been changed for one of a different type. When a meter of that type was used for gas coming from the retort house, they were up against a big proposition, because he was not at all sure that gas coming from a retort could be considered a gas at all. There were very large globules of tar, and it was difficult to meter even with a cleansing device to keep the orifice clean. The trouble in the particular case he was referring to was the one experienced by so many gas-works—viz., the difficulty of knowing how much each of the retort houses was making, and it was difficult to separate the streams of gas from each retort house right up to the meter. The aim was to obtain some idea of the output of each retort house, as a guide as to which were good and which were bad retorts. There had been no device with the self-cleansing gas meter for taking into account the density of the gas, and therefore certain assumptions had to be made as to the density and also the water content. In addition to the trouble from tar, there were also great differences in temperature; there might also be a breakdown in one retort house, and generally there were varying conditions which made it difficult to measure the gas accurately. However, the experiment of using the self-cleansing meter was an interesting one, and well worth doing, because they certainly got some idea of how much gas the particular retort house was making compared with other retort houses. What was more interesting at the time was the information obtained with regard to the duration of charges. They were working 12-hour charges and two 8-hour shifts, and the diagrams obtained were very interesting indeed. They found, for instance, what some people had not reckoned with—viz., that the flow was varied from zero to something very much in excess of the normal maximum. At one time it was found that they were nearly blowing the seals because they had not taken into account the very large differences in flow that occurred, and which were shown up for the first time on the diagrams of the meter. He had had a good deal of experience with the types of meter described by Mr. Hodgson in measuring clean gas, and there were means for checking them against the station meter of the positive type, though there was the difficulty at times of not being able to measure different rates of flow. At the same time, in those cases where the gas was measured and checked against the station meter, the accuracy was found to be within 1 p.ct. There had been certain difficulties due to the fact that in his case they were working with very high temperatures, and therefore it was necessary to make some difference in the calibration of the instrument. He gathered from the lecture that the venturi type of meter was likely to be displaced by the shunt type, and it would be interesting to know if the shunt type of meter was as accurate as the venturi type. One aspect of the venturi gas meter was the chart, of which he made very great use in observing from time to time how the "make" of gas was varying. These charts gave a very good indication of where purifiers had been changed, or whether there had been any unforeseen occurrence during the night, such as an accumulation of pressure, which did not usually arise. For that reason he did not think the chart should be done away with, though he did not suppose it would be a difficult matter to give a graphical representation of the gas that was being made at any particular moment.

Mr. HODGSON said he was interested in the remarks concerning the self-cleaning meter at Bromley. He had always been disappointed that the self-cleansing orifice had not been more employed, but he was glad to learn that, in spite of some difficulties, it had proved useful. As a matter of fact, he knew of the difficulties that had been mentioned by the last speaker, and it was pleasing to hear that such useful results were obtained in spite of these inherent difficulties. Mr. Lacey had said he would be sorry to see the venturi meter disappear because of the chart, but he had mentioned during his lecture that the "fan-shunt" meter could have a balanced recorder put across it as a chart recorder; also, that, whereas the old venturi recorders would only give an accuracy down to about one-fifth of full flow, the new and simpler balanced recorders would give an accurate record down to one-twentieth of the full flow.

Mr. H. WADSWORTH (Tottenham and District Gas Company), speaking with regard to moisture content at different temperatures, observed that he had found, by taking dew-points, that the gas coming from the meter was saturated; and this made matters much easier. Mr. Hodgson had shown a square-edge orifice in one of his illustrations, and a dimension had been given for the thickness of the disc. He would like to know if that dimension was the result of practice, or whether it was on a theoretical basis. If so, could some idea be given as to how the thickness of the disc was obtained?

Mr. HODGSON, in replying to the first point, said the gas in a gas-works was almost always saturated, and that it was usually safe to make that assumption. With regard to the thickness of the disc, the dimension he had given was entirely empirical. There was no "best" thickness, and the actual thickness did not matter so long as the correct thickness was used for any particular set of curves.

Mr. A. G. GRANT (Gas Light and Coke Company) remarked, in regard to the shunt meter for industrial purposes, that it seemed to him that this would fail for small flows where, for industrial purposes, it was necessary to measure the amount of gas supplied, however small. Would it be possible in that case to arrange a valve and divert the gas through a positive meter? How far did turbulence affect the disc in the shunt meter, and must there be streamline flow?

Mr. HODGSON said that, in regard to the shunt meter for industrial use, there had not been many inquiries for it for that particular purpose. There did not seem to be a desire to use it, but if there was it would be possible to arrange a throw-over valve so that, when the flow was below a certain amount, a positive meter could be brought into action. His firm already used the method in the case of water meters, and there was no reason why it should not be applied to gas. The accuracy of the shunt meter depended entirely on the calibration in each case. An accuracy of 1 p.ct. could be obtained, but, to be on the safe side, not more than 2 p.ct. accuracy was guaranteed.

Mr. P. H. P. SMITH (South Metropolitan Gas Company) speaking with regard to the pitot tube form of apparatus, suggested the greatest difficulty with this apparatus was caused by the variation of pressure across the main. This made it difficult to get the average velocity.

Mr. HODGSON said the thing to do in cases of uneven flow distribution was to take traverses right across the main. There were frequent instances in which there were obstructions and variations on the up-stream side. But by taking traverses with the pitot tube, it was possible to obtain an accuracy of within 1 p.ct. or 2 p.ct.

Light-Reflecting Powers of Flowers and Foliage.—A paper on this somewhat out-of-the-way subject was presented by Mr. S. G. Hibben at the Annual Convention of the American Illuminating Engineering Society, held in September last. Green foliage in general reflects relatively little light; tree leaves usually reflect about 15 p.ct. in summer, grasses somewhat less, whereas the brighter flowers may reflect in some cases 75 p.ct., and on an average 50 p.ct. Mr. Hibben's investigation is of interest to those concerned with the floodlighting of parks and gardens. Of the possibilities in this direction Mr. G. E. Shoemaker spoke with enthusiasm.

ELECTRICAL PLANT IN GAS-WORKS.

By W. E. STEPHENSON, of South Bank.

[Paper before the Yorkshire Junior Gas Association, Dec. 14.]

The introduction of electricity into gas-works can be said to date from the advent of the electrically-driven stoking machine, since which time its field of employment has rapidly enlarged, until to-day it has become the recognized power medium for driving almost all the mechanical plant and auxiliaries.

When contemplating the installation of electrical apparatus in a works, it is first of all necessary to decide upon several important matters about the nature of the current. When a statutory supply is available, the question is sometimes solved; though in the majority of cases gas engineers prefer to generate their own current, even when the cost of generation is slightly higher, rather than risk a failure of supply.

If generation at the gas-works is decided upon, it is a good plan to synchronize the voltage with that of the public supply, so that the latter may be used as a stand-by, or *vice versa*. This is, of course, a financial problem, and is governed by the cost of generation *plus* the interest and depreciation on the plant, as against the price at which the current can be purchased from the public authority. In some cases a greatly increased price is charged when the current is only used for stand-by purposes, while in others there is a fixed minimum charge. When the currents are of different natures, this arrangement cannot obtain unless a rectifier is installed; but I propose to deal with this matter later.

ALTERNATING CURRENT MOTORS.

There are two types of 3-phase alternating current motors—the squirrel-cage induction motor, and the "slip-ring" motor. As a rule, the squirrel-cage motor can only be used for comparatively small powers, as its starting torque is very small, taking about three times the full load current for starting. The rotor resistance is very low, and, therefore, the motor is highly efficient, while its simple construction renders it mechanically robust and comparatively cheap to manufacture. When a squirrel-cage motor is used for driving a small crane or telpher, where a large starting torque is more important than high efficiency, because of the intermittent nature of the load, it is usual to increase the rotor resistance by making the end rings, and sometimes the bars as well, of high-resistance metal—e.g., German silver.

The speed of these motors is fixed by the periodicity of the current supply, and is not variable by control. For constant speed work, such as driving small conveyors, elevators, fans, centrifugal pumps, &c., where not required to start and stop frequently, they are the best all-round proposition for work up to 5 or 6 H.P. Their disadvantages are that they require a comparatively high starting current (about three times full load current), and have a relative low starting torque and a fixed speed. In fact, the speed of all induction motors falls no more than 5 p.ct. between no load and full load; this is due to what is known as "slip"—e.g., the speed of induction motors for a 50-period circuit can be: 1450, or 950, or 750 R.P.M. full load, a 750 R.P.M. machine costing twice or three times as much as a 1450 R.P.M. machine for the same power.

The "slip-ring" motor is in most cases used for powers over about 6 H.P. It is more complicated than the squirrel-cage, as it has a wound rotor and "slip-rings" with brushes. The speed is variable within limits, as a resistance can be inserted across the brushes to give it a higher starting torque, thus enabling it to be started-up against load. This type of motor is suitable for intermittent work such as driving haulage or stoking machinery, as well as for continuous work and all uses for which the squirrel-cage can be employed.

DIRECT CURRENT MOTORS.

Direct current machines offer the following two main advantages over A.C.: They are capable of a wider range of speed control; and the "series" wound motor is an ideal arrangement for haulage systems. The wide range of speed control constitutes an essential requirement in driving certain gas-works plant, particularly the projector on certain types of stoking machinery, or the fan on a waste-heat boiler or water gas plant, while it is also demanded in certain systems of haulage.

There are three distinct types of D.C. motors, differentiated by their windings: The "shunt" wound; the "series" wound; and the "compound" wound.

The main circuit of the shunt-wound motor is through the armature, and a small amount of current circulates the thin wire of the magnet coils through an external resistance. It is the quantity of current flowing through this circuit which governs the speed of the motor. This is known as the "shunt winding."

The shunt-wound electric motor is an ideal driving agent for a varying load where constant speed is required. Without any special governing device, it runs at practically the same speed from no load to full load, and shows no tendency to "run away," even momentarily, when the load is suddenly removed. There is, of course, a slight drop in speed when the load is put on, but the larger the motor the smaller this variation.

The governing agency is the current in the shunt winding, if this current is reduced by the addition of an external resistance over and above the resistance of the magnet coils, the speed will increase, and the increased speed will remain nearly constant, in spite of fluctuations in load. There is, however, no way of decreasing the governed speed below the normal for which the motor is built, unless the voltage is altered. With special magnet coils of lower resistance arranged so that the shunt regulator resistance is partly in at normal speed, the speed can be reduced to some extent. The saturation of the magnetic circuit generally limits this reduction to about 10 p.ct. in standard commercial machines.

SLOW AND HIGH SPEEDS.

Theoretically, the power of a motor varies directly as its normal speed. At normal excitation, the number of turns on the armature will determine the speed at a given voltage, and twice the number of turns will give half the speed, less a slight correction which makes the speed rather less than half. This at the most would mean half the section of copper in each turn; therefore half the current carrying capacity and half the power. This rule holds good in practice over a considerable range. At very slow speeds, however, the lessened ventilation in the motor further decreases the power to some extent.

Regarding the relative advantages of slow and high speed motors, the high-speed machines are relatively more efficient at full load than the slow, but at light loads they are not so efficient, owing to the greater proportion of core losses—*i.e.*, losses in the armature due to the many reversals of magnetism.

There is often a great deal of power wasted in running high-speed motors with small pulleys. For example, suppose a shafting has to run at the speed of about 160 R.P.M., and the size of the driving pulley is limited to 48 in. or less, it is bad economy to drive with (say) a 10-H.P. motor running at 1280 R.P.M. necessitating a 6-in. pulley. By using a 12-in. pulley, and a motor running at half the speed, the saving in the power absorbed in slip and bending the belt round the pulley would very soon pay for the extra price of the slow-speed machine, apart from the matters of motor efficiencies and the wear and tear of belts. The question of the relative wear and tear of the motors is not a serious one, though, of course, a slow-speed motor is generally rather more satisfactory.

Extra high-speed machines are used for driving direct-coupled water gas blower and waste-heat boiler fans, &c., and are very costly owing to the many special precautions which have to be taken on account of the great centrifugal stresses that come on the commutator, binders, &c.; accurate balancing is also very important.

RATING OF SHUNT MOTORS.

Electric motors automatically respond to the demands made upon them, not only within their rated capacity, but also very much beyond it. The first result of very much overload on a shunt motor is sparking on the commutator. The armature will, of course, still revolve, and will not stop unless the supply voltage falls very much, or actual damage is done to the commutator or brush gear. If, however, the overload is kept on for some time, the armature will become overheated and the insulation may be damaged. The heat generated by an electric current varies as the square of the current, so that twice the current will give four times the heat, and so it is obvious that with excessive overloads the overheating will be very rapid.

It will thus be seen that the rated horse-power of a shunt motor is not, and cannot be, its maximum power. The universal practice with the manufacturers is to rate their machines on a temperature rise basis; and a maximum rise of 75° Fahr. above the surroundings after any length of run at full load has become the standard of rating both for dynamos and continuous ventilated motors. With machines of moderate size, after a full load run of six hours the temperature settles down and does not continue to rise, so this is generally taken as the period of the test run.

The sparking limit—*i.e.*, the load at which the sparking begins—varies very much with the speed and voltage, but in any case there ought not to be any serious sparking until the rated load is considerably exceeded, and this with the brushes in their no-load non-sparking position. The rating of series-wound motors is done on quite a different basis, and will be dealt with later.

SERIES-WOUND MOTOR.

The series-wound motor behaves differently from the shunt. In some ways it is analagous to a steam engine without a

governor, whereas the shunt motor is like a steam engine with a good governor. A series-wound motor has advantages for crane and traction work over a reversing steam engine in that the torque increases in a greater ratio than the current flowing.

The maximum torque which can be exerted by any steam engine, even with steam throughout the stroke, is the boiler pressure times the area of the piston; and this torque is to a great extent independent of the speed. In this type of machine, on the other hand, there is, within reason, scarcely any limit which can be exerted; and the torque has a fixed relation to the speed.

In a given motor, the greater the torque the less will be the speed, so that, without any regulation, the motor will adapt itself to the load, and in the case of a crane motor will lead a heavy load at a slow speed, and a light one at a high speed. In effect, the motor has in itself the power to change the ratio of its gearing according to the demand on it. The reason for this is that, in a properly designed crane or haulage motor, when the current is doubled the torque is considerably more than doubled, because not only is the current in the armature doubled, but the magnetic flux is also increased.

If it were not for the fact that the iron or magnetic circuit of a motor becomes saturated after a certain point, the torque in a series-wound motor would always be directly proportional to the square of the current, so that twice the current would give four times the torque. Of course, twice the current could not do more than twice the work, so that obviously in such a case the speed must be reduced to half—*i.e.*, four times the torque at half the speed would be obtained from double the current.

It is this automatic change-speed effect which makes the series-wound motor so successful for driving cranes, winches, &c., together with the facility with which these motors can be coupled up either in series or in parallel, which is simply an extension of the same effect.

The best method of rating is that which gives the ratio between the time that the motor may be required to work at full load and the total time running and standing. Thus a crane motor might be lifting its heaviest load for one minute, then standing while the crane is traversing for two minutes, then lifting full load again for one minute, and standing for two minutes, and so on.

The intermittency factor would then be $\frac{1}{3}$. It would be the safest to ignore the time occupied in lowering in a case like this, because the motor would then be working at part load, and it would not be fair to take it either as running or standing. The standard intermittency is for a maximum temperature rise of 75° Fahr. above the surroundings if the load is "on" and "off," according to the factor for an indefinite period.

With a great majority of cranes, as the maximum load is lifted only very occasionally, the motor is working generally at one-half or one-quarter, or even less, so that it is at this part of the load that the efficiency is of the greatest importance.

Compound Wound Motor.

This type of motor has both shunt and series windings. The more series windings there are, the easier it will be to start-up the machine, and the greater the overload that the machine will take without sparking, and also the greater the speed variation between no load and full load.

There are some jobs, such as driving the stoking machine ram, or, in lighter work, a machine tool, where a smaller motor may be used if it is compound wound, because of the much greater momentary overload admissible, which in such cases may safely be 100 p.ct. for the peak.

Alternating current motors are cheaper to instal and maintain than direct current motors; they are less likely to fail, as there is less to go wrong with them; and they require less attention.

Speed control of D.C. motors is an important advantage, while, on the other hand, the cheapness and simplicity of the alternating machines cannot be easily overlooked.

Generation and Bulk Supply.

This is purely a financial problem, the governing factors of which are:

(1) The cost of the current to the gas undertaking.
(2) The cost of a transformer (if required).
(3) The quantity of the waste heat available, and the cost of its recovery.
(4) The cost of the "make-up" steam to assist the steam from the waste-heat boilers.
(5) The cost of the gas into the holder.

1. The cost of the current from the public supply authority can easily be obtained upon application, but the undertaking would want either a guaranteed consumption, which in all probability would be at least the amount used by a smaller or medium sized gas-works, or else they would charge a rent to cover the cost of the interest and depreciation on the material and plant, *plus* a very high rate for the small quantity consumed. Figures which come to light from time to time seem to show that the fixed rent and high tariff basis is not a sound financial proposition, while there is always the risk of failure of supply. We are therefore brought to the conclusion that it is best either to buy or to generate the whole of our requirements and instal stand-by plant.

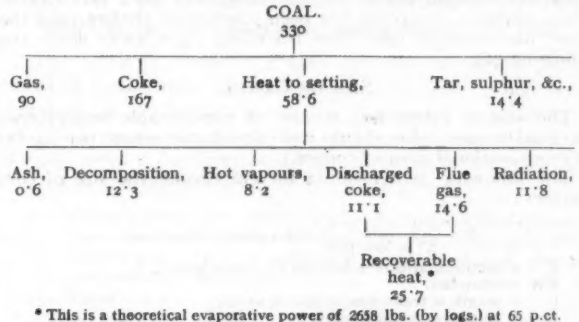
2. In all probability it would be necessary for the undertaking to purchase a transformer, or, perhaps, as is best in the majority of cases, four small ones—three to work and one as a spare. If the D.C. system is decided upon, a further charge will be incurred by the purchase of a converter.

3. The economy resulting from the employment of waste-heat boilers has been frequently proved during the past few years, and it is therefore incumbent upon us to recover all the waste heat which is financially possible, for not only is it a cheap form of power, but the recovery also increases the thermal efficiency of the plant. We must look to the recovery not only of the waste heat from the retort house flue gases, but also from the coke. I feel that there are times when we fail to realize fully the amount of sensible heat lost during the quenching operations. The following figures illustrate the distribution of heat in the retort setting:

Used in the Retort.	P.Ct.	*Lost in the Setting.*	P.Ct.
Decomposition and distillation	21	Flue gases	25
Escaping gas vapours	14	Radiation and convection	20
Hot coke	19	In ashes	1

In a paper read last year dealing with the Sulzer plant Mr. Clegg, of Burnley, stated that they obtained 937·6 lbs. of steam from water at 212° Fahr. per ton of coke treated in the plant—see "JOURNAL," Vol. 184, p. 785. With an engine using 45 lbs. of steam per B.H.P.-hour, the horse-power available would be 20·8. Converting this to electricity with an over-all generating efficiency of 75 p.ct., the power available would be 11·7 KW.-hours, *less* 2·7 required to work the plant. This leaves 9 KW. per ton of coke cooled, or 5 KW. per ton of coal carbonized. This is shown on the chart.

Heat Distribution in Therms.



* This is a theoretical evaporative power of 2658 lbs. (by logs.) at 65 p.ct. evaporative efficiency = 1728 lbs., into power at 45 lbs. of steam per B.H.P. = 38·2 B.H.P. per ton of coal carbonized.

4. When more energy is required than that coming from the waste-heat plants, the "make-up" steam must come from the works boilers, which should be of such size and condition as to cope with any sudden demand upon them.

5. The cost of gas into the holder merely relates to its employment in the event of a gas engine set being installed.

It seems to me that in the majority of cases generation by the steam from the waste-heat boilers will be the best policy to adopt, with the "make-up" steam drawn from the works boilers.

Converting or Transforming an External A.C. Supply.

When an external A.C. supply is required to feed a D.C. circuit, a rectifier of some kind is necessary. There are both mechanical and static types, and the choice is to a large extent dependent on the size and character of the installation.

Of the mechanical types, the most important are: Motor-generator sets, rotary converters, and motor converters.

Of the static, the most universal is the mercury-arc, and for powers below 50 KW. it is a very good proposition, as it is cheap to instal and requires less attention than the mechanical types.

The motor converter is perhaps rather more suitable for gas-works purposes than the rotary because:

(*a*) It has exceptionally good commutating properties.
(*b*) It has about the same efficiency as a rotary, in the region of 92 p.ct. on full load.
(*c*) No step-down transformer is required, even when working from H.T., unless the voltage is greater than 11,000. This makes up for the greater ground space required by the two separate machines.
(*d*) No synchronizing is required; starting is like an ordinary induction motor.
(*e*) The voltage can be regulated to the extent of about 40 p.ct. without any extra apparatus.
(*f*) There can be no reversal of polarity.

The efficiency of the mercury-arc converter is about 98 p.ct.

Transformers.

Should an alternating current circuit be decided upon, a transformer will be necessary. The transformer can be in either one or several units. To instal several units is more costly, and

takes up more ground space; but, on the other hand, a spare unit can be carried, so that, when a breakdown occurs, repairs are less costly.

Typical efficiencies of transformers at full and quarter load are:

	Full Load. P.Ct.		Quarter Load. P.Ct.		Full Load. P.Ct.		Quarter Load. P.Ct.
5 KW.	97	..	94·5	100 KW.	96·5	..	93·5
50 KW.	98·3	..	97·2	500 KW.	97·8	..	95·6
2500 KW.	98·7	..	96·5				

MAINTENANCE OF ELECTRICAL EQUIPMENT.

Coal and coke dust, in company with sulphur and ammonia fumes, is present in varying degrees of concentration in all parts of the works, so that the use of totally enclosed motors and switchgear should be the general rule.

The cables should also be given adequate attention. It is best to provide armoured cables wherever possible, and to keep them well painted with a good special cable paint. This precaution will reduce corrosion to an almost negligible amount, and thus prolong their lives indefinitely. Ordinary paint cannot be recommended.

When fixing the cables, care should be taken to avoid unduly hot walls and places which may cause abrasion, especially with light cables which swing in the wind.

The possibility of liquor, acid, or water dropping on the cable should be guarded against. No cable should be laid through a store where it is likely to be damaged or even covered by coal or coke; it should never come into contact with a boiler or steam pipe.

For internal work, I think it is better to use conduit rather than the lead covered material, as I have known several shorts, followed by fires, caused by the electrician cutting too deeply through the lead, and so damaging the internal insulation. This has escaped notice, and all has gone well for a time. Then, perhaps, the cable has been touched or shaken, and the short has occurred, the blaze travelling right away down the whole length.

SIZE OF CABLES.

The size of cables is a matter of considerable importance; the load on any cable should not exceed 1000 amps. per sq. in. of cross-sectional area of copper.

The following is a formula for calculating the size of conductors:

$$S = \frac{KW \times L \times K}{E^2 \times \text{loss p.ct.}} \text{ (for a given voltage loss).}$$

S = sectional area of conductor in square inches.
KW = kilowatts.
L = length of transmission line in yards.
E = voltage at feeding point.
Loss p.ct. = the drop in volts between supply and feeding points expressed as a percentage of the volts at a feeding point.

VALUES OF CONSTANT K.

For Continuous Current or Single Phase Alternating Current.

For single conductor	2·5
For two conductors—*i.e.*, 2-wire system	5·0
For two outer conductors of 3-wire system	1·25

N.B.—Here E = voltage between outer and neutral wire. In practice, the neutral or middle wire is taken as half the area of an outer wire.

For Alternating Current Systems.

Each conductor of 3-phase or mesh or delta E = voltage between any two wires.	2·5
Each conductor 3-phase star connection E = voltage between any two wires.	2·5

CARE OF MOTORS.

The cleaning of the motors and switchgear is of considerable importance; systematic inspection and blowing-out of the dust should be done regularly, together with the fitting of new brushes where necessary. The question of brushes is also very important. Any old brush which happens to fit the particular holder will not do. Carbon brushes are made in various degrees of hardness, and, generally speaking, the higher the voltage the harder they should be. When ordering new brushes, it is best either to send a sample away to a reliable firm of manufacturers, or else to write stating your requirements very fully.

SPARKING AT THE COMMUTATOR.

The principal causes of this defect are:

(*a*) The machine is overloaded; this may be proved by the use of a reliable ammeter.
(*b*) The position of the brushes requires adjustment.
(*c*) The brushes are too tight in the holders, in which case they may be clogged with oil or dirt.
(*d*) The brushes do not bed accurately on the commutator.
(*e*) The pressure on the brush is not evenly placed.
(*f*) The commutator is untrue, and requires polishing.
(*g*) The mica between the segments projects, and requires cutting down.

The practice of cutting-down the mica segments on the commutator is sometimes, I think, carried too far, with the result that the brushes wear away too quickly. A brush of the correct grade should wear the mica equally with the copper.

Discussion.

The PRESIDENT (Mr. F. Firth, of Leeds) said that the attitude of the gas industry generally towards the use of electricity on gas-works was one which must necessarily raise a good deal of anxious thought, but they must not be conservative to the extent of depriving themselves of any helpful medium merely because it might happen to be a competitor with their own industry in certain directions. A leading article in the "GAS JOURNAL" of the current week, remarked Mr. Firth, had pointed out the characteristic attitude of the electrical people in regard to the equipment of council houses without any consideration of, or consultation with, the tenants themselves. The particular instance giving rise to the article was at Barnsley, but it was by no means an uncommon occurrence. If, however, the electrical people must persist in that attitude, in their haste to secure business, the gas industry had no need to adopt any such form of injustice to a rival industry. The gas industry was old enough and strong enough to be able to accord recognition to the good points even in a rival, and to admit readily that electricity, as well as gas, had its own sphere of usefulness. If they in the gas industry found that a particular type of energy was suitable for the purpose, they should not disdain it merely because it was made by their competitor.

Mr. C. H. CHESTER (Wakefield) suggested that the application of electrical energy in a gas-works was limited from an economic point of view to the larger or medium-sized works. From this point of view alone he questioned the wisdom of going to electricity for power, in the case of a good many works. In reckoning what would be the cost, they had to look further than the actual cost of electrical plant installation and running. They must think of the effect on the gas load, and the valuable possibilities of utilization of their own product by means of engines. At the works at which he was engaged the comparative costs as between gas engines and dynamos and the purchase of electricity in bulk had been investigated in 1925, and they found they could produce their own electricity much more cheaply than they could buy from the town's supply. Certainly the gas industry was not left much choice as to driving power in regard to modern stoking machinery, which demanded electricity. If they were going to generate from waste heat sufficient electricity to keep their works running he was in entire agreement with Mr. Stephenson; but if they had to produce steam for the production of energy for other purposes, they must consider that the maintenance of the plant required skilled attention; and it was not always possible for works below a certain size to keep a skilled electrician for maintenance and repairs. At his works they had applied electricity to some purposes, but it would not pay them to change over their exhausters from steam to electricity, even if they provided the electricity themselves from waste heat. It had to be recognized that the electrical motor, up to the present, at any rate, was not as efficient or reliable as the steam engine for driving exhausters. As far as concerned the application of electricity to washers, he felt that the cost made the proposition doubtful.

Mr. D. T. LIVESEY (Doncaster) said that the paper would be particularly useful to those of them who had a limited electrical knowledge and who had no trained electrician on their works. It was satisfactory to know that the paper was going to be printed in the "GAS JOURNAL."

The PRESIDENT said it would be useful to have figures of the relative efficiency of generation of electricity by (say) gas and steam. Some figures had been given in the "GAS JOURNAL" in 1928 by Mr. Finn and Mr. Ray [C. P. Finn and R. Ray—see "JOURNAL" for Sept. 26, 1928, p. 664]. The efficiency of electricity generation from gas had been given as 27·8 p.ct. With coal, in the ordinary generating stations, the efficiency was about 16 p.ct. This meant that gas was about 1·7 times as efficient as steam; but, of course, they had to remember that the price of gas as compared with the cost of generating from steam at the price of low-grade coal might counteract that advantage. Personally, he felt that, if the gas industry had been a little more far-seeing, and had applied the same amount of thought and attention to the generation of electricity by way of gas as had been put into the turbine, they might to-day have actually had the electrical business in their own hands.

Mr. E. GILLETT (Bradford) remarked that there was much to be said for the easy handling of electrical plant, but he thought gas engines were as easily handled—perhaps more easily. At his works, the smaller motors had suffered rather serious effects from damp, and had had several breakdowns. Personally, he was not particularly elated with electric motors, though it was hardly fair to criticize until one had had rather more experience with them.

Mr. G. E. CURRIER (Leeds) said that his experience of electrically-driven machinery was that he had rarely been let down by it. He thought the reliability of electric apparatus, after all, was largely a matter of systematic examination of motors, starters, switches, records, &c. On the works on which he was engaged, their more important motors were inspected by a skilled electrician once per month, and any minor repairs put into effect at once. Every two years the motors were taken into the electrician's shop for a thorough overhaul; and he regarded this as very important. Another important point was to see that every motor was fitted with an ammeter, so that any overloading could be detected. They found great advantage in the application of electricity to the gravity-bucket conveyors. With all electrical machinery it was advisable to put in safety devices, in order to knock the main switch out of the motor, and bring that part of the machinery to an instant standstill if required. One could not apply safety devices with the same ease to gas or steam driven machinery. They of the gas industry must not be conservative, but must recognize that in the retort house and in certain parts of the coal and coke handling plant the electrical drive —if they got the right price for the current—was a very good pro-

position. In Leeds they obtained their current at 1d. per unit; and he felt satisfied that it was a paying proposition. The cost of electric motors came in rather heavy where they were running continuously throughout the 168 hours each week. A 10 H.P. motor, running continuously throughout the week, at 1d. per unit cost £6 10s. At Meadow Lane, said Mr. Currier, they kept very careful records of any electric lamps used, and a weekly record of all current employed on the electrical installation on the works.

Mr. RALPH HALKETT, Junr. (Sheffield), said he would not like to be without electric motors on a gas-works to-day. At the Sheffield Works they utilized current which they generated themselves, and also the Corporation supply. Some seven years ago, at the Neepsend Works, they found it necessary to have a bigger generating plant, and they decided on a set of four-cylinder "Premier" gas engines of 400 H.P., coupled with Crompton dynamos. These engines were run on week-days when the load was at its maximum. At week-ends, when the load was light, the engines were stopped, and the town supply of current was brought into operation through a rotary converter. The cost of electricity per unit must be based on the maximum load. Mr. Halkett said he would like to know if Mr. Stephenson had had any experience of electric motors in gritty atmosphere, and, if so, what type of totally-enclosed motor he had found most suitable.

Mr. R. N. WEBB (New Wortley, Leeds) suggested that the value of the application of electricity depended largely on the disposition of the machinery in a particular works. In his works, it was a plant on which there had been no capital expenditure for a considerable number of years, and therefore to some extent it might be considered as out of date when compared with some recent installations. The stoking machinery was hydraulic and compressed air, put down in 1896, but it was doing exceptionally good work to-day, with the same pumps and the same motive power—steam. The inclined retort house was erected in 1904, and had "National" gas engines (75 B.H.P.) for motive power. By this means they were lifting 220 tons of coal per day, and one engine drove all the machinery. He had never gone into the comparative costs, but he felt sure that a better type of motive power would be adopted, whatever it might be, if it would suit the purpose better. The gas engine demanded very little expense or trouble. Gas engines were a reliable source of power, and at New Wortley the mechanic spent much more time on outside jobs than on his engines, which showed how little trouble they gave. The engines had been working without any trouble since 1904. Personally, he could not recommend the installation of electrical drive in that retort house. With regard to the hydraulic stoking machinery, it put in 12-hour charges with complete satisfaction, and they could not expect to do more than that with electricity. Mr. Webb agreed that hydraulic machinery was liable to be a bit dirty. Compressed air was exceedingly good for the power one got out of it, and at New Wortley the compressed air machinery had worked extremely well. There was, he thought, nothing better than compressed air for drills or boiler-scaling hammers; &c. In many ways it was, in his opinion, superior to electricity. At the same time, they could not close their eyes to the fact that electricity had its uses and its conveniences, which were very many indeed. In isolated coal-breaker pits where one had to carry steam piping, if one had not much room the steam engine working with belting, &c., might well be replaced by an electrical motor. He was, of course, looking at the matter from the point of view of reliable continuous working of the plant, rather than that of cost. For telpherage work, he knew of no better power that could be substituted for electricity. The motors at New Wortley were of the slip-ring type, and they caused little difficulty. The great trouble with electricity, of course, was that the whole of the plant dependent on a particular motor was stopped while some little trouble had to be searched for, and then might be such as could be put right in a few minutes. They of the gas industry would, of course, like gas power to be universal, but they must adopt any kind of power, if satisfied that it was more convenient and cheaper than the one in use. In thinking of the adoption of electricity, however, they must have carefully in mind a very important factor to which due consideration might not always be given. The more electricity was adopted, the more coke and coke breeze was liable to be thrown on to the open market, because of reduced use on the gas-works; and this must in the ordinary course of events tend to bring down the prices obtainable. This factor should be debited against any financial gain expected from the extended use of electricity on gas-works.

THE AUTHOR'S REPLY.

Mr. STEPHENSON, replying to the discussion, said he agreed with Mr. Chester that at present, at any rate, it was not a practicable policy to employ electricity for driving exhausters. In regard to the comparative efficiencies of steam or gas engines in the generation of electricity, the gas engine was certainly efficient; but they had to consider that, unless one used waste heat, one had to generate the steam in the boiler before it could be employed in the engine—apart from any question of condensation, &c. He thought the employment of gas engines for generation of electricity was good. He was of opinion, indeed, that the establishment of generating stations at gas-works should be more closely considered. Near his works there were large ironworks with a number of coke ovens, and they had 2000-H.P. gas engines. They had waste-heat boilers on the exhaust pipes. He was informed that the consumption of gas per horse-power-hour was very low, and they raised a considerable quantity of steam from the exhaust gas. If a scheme could be formulated whereby a gas undertaking could supply an electricity undertaking with surplus energy, it would be very beneficial. In Durham County there were collieries which did this in supplying a balance of power, after their own requirements, from the plant from their waste heat, and selling it to the electrical power company, thereby bringing in revenue. In regard to the generation of electricity by gas, the low-temperature carbonization process was making great progress. Mr. Stephenson said he entirely agreed with Mr. Currier's remarks as to the proper care of electric motors, which was essential if they were to function properly. Sometimes the ammeter, like all scientific instruments, was liable to go wrong; and it should always be kept in good condition. Safety devices, as mentioned by Mr. Currier, were necessary, particularly on a large works, or there might be serious damage to life and plant. So far as concerned distribution of power in the works to his mind electricity was superior to any other form of energy. Gas engines involved long services, which were always liable sooner or later to become blocked with naphthalene, water, &c.; while with steam there was often trouble by condensation in the steam lines. In answer to Mr. Halkett, he said that the totally enclosed motor was desirable in a gritty atmosphere, with pipe ventilation. Mr. Webb's remarks on hydraulic power and compressed air were very interesting. Hydraulic power was exceedingly good for (say) wagon tipping, cranes, &c., though it was sometimes, as Mr. Webb had said, dirty. One great advantage in using electricity for elevators, &c., was the entire avoidance of belting, which was never very reliable, and was often dangerous. Gearing was better, because one could put a guard round it; it did not require the same amount of attention, and was more reliable. The question of throwing more coke and breeze on to the market by adoption of the electrical drive was certainly a problem. At South Bank they used up most of their breeze mixed with cheap boiler slack. They employed no large coke at all.

VOTES OF THANKS.

Mr. R. HALKETT, Junr., proposed a hearty vote of thanks to Mr. Stephenson for his paper; and Mr. LIVESEY seconded.

On the motion of Mr. J. W. WOOD, M.Sc. (Leeds), seconded by Mr. CHESTER, thanks were voted to the Leeds Corporation and Mr. Towers (Town Hall Superintendent) for the use of the room for the meeting.

STATISTICS OF THE CANADIAN GAS INDUSTRY.

Extracts from the Report of the Inspection of Electricity and Gas for the Fiscal Year ended March 31, 1929.

The work in connection with the Gas Inspection Service reached a maximum during the year just closed. There was a total of 134,161 meters tested—an increase of 11,477 over the previous year—and of this total 44,744 were new meters, the largest number ever presented for verification in one year.

Gas is sold in Canada under two main classes:

(1) Manufactured gas, which includes straight coal gas, carburetted water gas, coke oven gas, acetylene gas, and a mixed gas which is usually a mixture of coal gas and carburetted water gas.
(2) Natural gas.

The volume of manufactured gas used during the past year was 16,922,023,500 c.ft.—an increase of 867,187,500 c.ft. The number of meters used to measure this volume of gas was 504,500, an increase of 22,067. During the year 3428 calorific tests were made throughout the Dominion, the average value being 495·4 B.Th.U. per c.ft. The standard set by our regulations is 450 B.Th.U. per c.ft.

The production of natural gas continued to increase at a very rapid rate during the past year; 25,491,446,000 c.ft. being supplied—an increase of 5,141,446,000 c.ft., or approximately 25 p.ct. This increase took place mainly in the district of Calgary. The number of meters in service at March 31, 1929, measuring natural gas was 107,594—an increase of 8589 for the year.

Provision is being made in South-Western Ontario to supplement the diminishing supply of natural gas by the addition of a manufactured gas. An auxiliary gas plant with a maximum capacity of 6 million c.ft. of gas per day, made from fuel oil, is being constructed at Windsor, and further provision has been made when the need arises to erect a coke oven gas plant.

A noticeable feature in connection with the gas industry is the large quantities of gas that are being used by industrial concerns. It naturally follows that the accurate measurement of such quantities is becoming more and more important—a subject in which the branch is vitally interested. In the past we have been accustomed to testing meters having a capacity up to 5000 c.ft. per hour, which we have been able to handle successfully; but the testing of meters with capacities ranging from 25,000 to 250,000 c.ft. per hour is an entirely different proposition, and requires a great deal of investigation work.

Scottish Junior Gas Associations.—The Joint Transactions of the Eastern and Western Districts for the session 1928-29 have been published; and the volume indicates the growing strength of the two organizations.

Architects' and Surveyors' Pocket Diary.—The 1930 edition of this useful diary, which contains 56 pages of professional technical information, has been published by the Association of Architects, Surveyors, and Technical Assistants, 26, Buckingham Gate, Westminster, S.W. 1, price 2s. 6d. (post free, 2s. 8d.). The information includes surveyors' tables; technical memoranda; professional societies; prizes, courses of study, &c.; district surveyors in London; R.I.B.A. allied societies overseas, &c.; 48 pages squared ruled paper.

GAS SALES POLICY.

By H. W. Willmer, Showroom Superintendent, Bath Gas Company.

[Paper before the Western Junior Gas Association, Dec. 7.]

There are various methods of obtaining new consumers and retaining present consumers, and we have found the following methods very helpful: Take careful note of all new applications for gas, also transfers from one address to another, for the purpose of carefully following up and interviewing the applicant. This is often welcomed by the consumer. For many years we have been in close touch with the house agents of Bath, who are quite willing to give particulars of names and addresses of persons who intend residing in Bath and district, and also names and addresses of people moving from one house to another. The house agent is better pleased if you take an advertisement space in his official brochure, which is issued once or twice a year, and he will then give names and addresses of property transfers without fee, which is usually part of the bargain. It is advisable to obtain these particulars at very frequent intervals; otherwise you will find you are too late in the field, and the builder or plumber has obtained the order to instal gas supply pipes and appliances.

Another way of trying to reach new consumers, or it may be old consumers, is to obtain names and addresses of people who are having houses built. This is done by obtaining permission to see the "Plans Passed" book, which can be inspected at the City or Borough Engineer's offices. Permission to take particulars from this book is usually readily granted, and among the details taken will be found houses to be built by the speculating builder, houses to be built specially for a known purchaser, extensions to houses and business premises, garages, and so forth. Just a few people when making a change of residence, either write or make a personal call at the gas offices or showrooms to make inquiries respecting the supply of gas and to purchase appliances for their new home, and whichever way names and addresses of prospective consumers are obtained, careful note must be made of them as they are of great value to the gas undertaking concerned.

These people should be followed up by a well worded letter, or, better still, a personal call by suitable officials of the company. What I mean by a "suitable official" is one who is thoroughly competent to advise on all matters relating to gas supply from the service to the fixed appliance; and it is necessary that he should have infinite patience, because the majority of applicants for a supply of gas have no knowledge of the subject whatever, and the only point which concerns them is the question of satisfaction with appliance or appliances they are about to instal. The official entrusted with the call must therefore give as much of his time in advising the consumer as he can reasonably spare.

One distinct advantage of having names and addresses of prospective consumers well in advance is for the purpose of getting in touch with the new resident before he has time to place his business elsewhere; otherwise the builder or decorator "picks the plum." These men are usually on the *qui vive* for all the jobs they can obtain, which include the supplying and fixing of gas cooker, gas fires, circulator water heater, gas lighting fittings, &c.

Get There First.

The new resident generally requires some alteration to the premises and re-decoration, and he finds that all his "gas work" can be done by the builder, who informs his client that his charges are less than those of the gas company, and, in consequence, the job is often given to him. Few gas engineers would have cause to grumble if the builder would carry out this branch of his business properly; but he rarely does so; and that is why it is necessary for you to get there first. The builder usually employs a plumber, and often a casual man, who is not a fully qualified plumber. The chief trouble is that plumbers, generally, are not good gasfitters, and therefore the gas installation suffers, with disastrous consequences to the gas undertaking. Again, builders do not care whether gas appliances are installed or not, as they are willing to fix any apparatus, whether gas, coal, or electric.

Some builders run inadequate supply pipes, and often connections are made to already overloaded pipes. We have found two or three gas fire supplies running off a ¾-in. compo pipe, which was originally fixed to supply a geyser only, and we all know what is likely to happen in such cases. If the plumber in question does think it advisable to run new and larger gas supply pipes, care is not taken to avoid condensation traps; we could all relate scores of instances of this kind. Later on, when the resident is nicely settled and commences to use his new gas appliances, he gets trouble with them. To whom does he complain? The gas company, not the builder or plumber, who is entirely responsible.

If we are late in getting in touch with our new consumer, he is led, as often happens, to purchase his new gas cooker and fires from the builder, who generally tries to obtain articles which will give him a good margin of profit, irrespective of the quality and efficiency of the appliances he is entrusted to instal. The efficiency of the appliances does not trouble him so long as his client is satisfied with the appearance. The builder hasn't to use the cooker, gas fire, or whatever he fixes, and therefore he shelves the responsibility, and passes it on to the gas company. Dissatisfaction follows, and gas is blamed, the fault being traceable either to inefficient apparatus, insufficient supply pipes, or careless fixing.

We are rather fortunate in this respect in Bath, as we have a fair proportion of builders who come to us, or send or bring their clients to select and purchase their gas apparatus and fittings. In this way, we feel that some degree of satisfaction is assured the consumer, as we only stock gas appliances of the highest efficiency.

Advise the Builder.

In the case of houses to be erected by the speculating builder, it is advisable to interview the builder to ascertain if you can be of service to him. Tell him you will be pleased to advise on sizes of piping, &c., and will quote for doing the work at a reasonable price, consistent with quality of materials used, and that you will see that satisfaction is given. This is our general practice, and we now have a large number of builders on our books who give us the whole of their gasfitting work. We allow a trade discount off all gas appliances purchased, but all fitting work done is charged at the usual rate. In this way we gain a distinct advantage, because the builder is satisfied, and, of greater importance, complete satisfaction is given to the consumer, who will reap the benefit of correctly installed gas supply pipes of adequate size, and neatly fitted efficient gas appliances.

In February last, as you well remember, we had an exceptionally cold spell, which brought in a good crop of complaints, the major proportion of which were traceable to defective pipes and fittings on consumers' premises. Soon after this cold period we had a very pleasing experience; not a few consumers were good enough to compliment us on the excellent and adequate supply of gas during that trying time. Three of the most important were a large hotel, a nursing home, and a large private house, each of which use gas for all purposes. The two first-named informed us that people came from other houses to them to get warm, having heard from guests that they were quite comfortable. In all cases where we received praise, we traced back and found that the whole of the gas installation was our own work exclusively. This proves that it is absolutely essential to see that all gasfitting work and piping, whether done by the gas company or by an outside contractor, is satisfactory when a house or other building is being overhauled, rebuilt, or newly erected. I am certain that no one except the gas undertaking can or will give the best service to the consumer.

Arouse Interest.

I think it is generally known that increased service can be given by arousing interest in the consumer, and this can be accomplished by enclosing one or two of the many well printed and attractive little folders in the envelopes containing the quarterly or half-yearly gas accounts. These folders are prepared from time to time by the "B.C.G.A.," and some excellent examples may also be obtained from gas appliance manufacturers. We have traced many sales directly to this method, and we have been not a little surprised at the number of inquiries, which we feel sure will eventually result in sales. This method of enclosing literature relating to gas appliances with gas accounts can be made more effective by inserting a corresponding advertisement in the local paper for a week or two while the gas accounts are being sent out. A simultaneous display in the showroom windows of the appliance or appliances advertised increases the interest, and will make the consumer even more impressed.

Having obtained our consumers we must take steps to retain them as customers and friends. If they are new consumers, or consumers transferred from one house to another, we must see that the new service pipe is of adequate size, and if it is an old service, see that it is clear and of ample size, and not likely to give immediate trouble. The meter must be of sufficient capacity to meet all demands. Advice can be given on size of fire, design and colour to harmonize with the scheme of decoration and furnishings of the rooms in which gas fires are to be installed. The gas salesman of to-day has a fine opportunity for making a pleasing gas fire setting, with such an array of designs and different coloured finishes in which gas fires are produced, thanks to the enterprise of the makers.

There should be no difficulty in satisfying a person with particular tastes as the selection is now unlimited. Art metal,

lacquered metal, also plain tiled asbestos and coloured sheet asbestos surrounds and hearths are now to be obtained for use in making a complete and pleasing gas fire installation. For very special work, we have of late used a fair quantity of "Manu" marble with great success. This material is made at Gloucester, and is most effective and pleasing as a background for gas fires. It is produced in a variety of shades, and it is therefore an easy matter to match a surround and fire in pleasing combination. "Manu" marble is very substantial material, less expensive than tiles, and much more pleasing for certain finishes. It is not quite as easy to fix as an art metal surround, but it is worth the extra trouble and care, which has to be exercised in making a smart job.

KITCHEN AND HOT WATER APPLIANCES.

With regard to gas cookers, here once more the gas salesman is fortunate. Cooker design and finish have advanced considerably during the last two or three years. The porcelain enamel finish has revolutionized the use of the cooker, and it is every housewife's aim and ambition to possess a cooker which can so easily be cleaned, and gas salesmen are often asked if an exchange can be effected by taking back the old black cooker and supplying an up-to-date enamelled model in its place. This is hardly a proposition, except in exceptional cases, as the demand for second-hand old type cookers is very low, and most consumers are naturally eager to take advantage of the newer types of cookers now on the market. The eye-level and range type cookers have quite a good sale, and are favoured in preference to the floor model where space permits. My experience in the sale of gas cookers is the difficulty of inducing housewives to select a cooker of sufficient size for the family requirements. Many times have I heard customers say after a few weeks' use, "You were right—a size larger would have been better; but I must make the best of it now." Therefore, a little extra care must be exercised to persuade clients to have an adequate cooker to prevent disappointment afterwards.

Water heaters, too, have been improved in design and finish, including the humble wash-boiler. Here is a great field; hundreds of housewives are beginning to realize how much easier and cleaner it is to use a gas copper in preference to the old solid fuel type, with its attendant dirt and uncertainty. Now that these newer gas wash-boilers have mottled enamelled exteriors, we find our sales of this appliance are gradually increasing, doubtless on the principle of "do as your neighbour does." A good window display now and again arouses interest and stimulates sales.

Geysers have also had the serious attention of manufacturers, both as regards quality and finish. The geyser in its new coat is no longer an offence to the bathroom. Geysers are now to be obtained in dark copper bronze, black and silver, or black and gold, and bronze lustre finishes. One firm of repute make a white enamelled cover over the working parts, and the exposed parts are chromium plated. This combination makes the finish everlasting. Flue pipes and bafflers can be obtained in finishes to match the geyser selected; therefore, the whole installation is neat, easily kept clean, and will grace any modern bathroom.

LIGHTING FITTINGS.

Modern lighting fittings are both effective and pleasing, and with superheater burners of various sizes and shapes, all kinds of gas-lighting can be undertaken, both in private houses and public buildings. These, coupled with switches—particularly the "Newbridge" switch and Sugg's distance control—will tend to keep present lighting consumers, and assist in obtaining new ones. We sent out with our last gas accounts, small illustrated folders of, "How to Switch on the Light." This brought numerous inquiries, and a number of definite orders were secured—in some cases for four and even six switches in one house.

Distance control for several lights or lamps is most effective for churches, public buildings, and shops. We are proud of the fact that we have satisfactorily relighted entirely seven churches in Bath, in face of keen electrical competition. This has only been done by studying the type of lamp or fitting required to suit the particular church, to harmonize with the style of architecture, and by installing distance control or switches for groups of lamps, or separate units as required. Careful study has been made of each individual case with very pleasing results.

We have recently fitted a newly erected two-storey stone-built sports pavilion with complete installations for lighting and heating, also a newly erected Sunday School, in competition with electricity. In all the aforementioned cases we have a special system of maintenance to keep lamps, distance controls, and switches in proper working order. It is only by attention at fairly frequent intervals to gas lighting in public institutions and shops, outside and inside, that we keep the load, and similar methods should be adopted if we wish to retain householders. If a householder complains of a poor supply of gas, or that one of his appliances is out of order, attention should be given as quickly and as promptly as possible. In special cases, I strongly favour a quick follow-up by the inspector, to see that the defect has been correctly remedied. Satisfaction must be given to the small consumer as well as to the large, and the small consumer is just as important as the other, and can give us an equally bad advertisement as the other if he is not satisfied with our treatment; therefore, a follow-up is not a waste of time or money.

MAINTENANCE.

As suppliers of gas we cannot rest on our laurels after the installation of gas appliances is completed. It is necessary that inquiry be made from time to time to ascertain if gas appliances, whether installed by us or privately, are proving useful and giving entire satisfaction. The best and most effective way is by a good system of maintenance.

Nowadays all gas undertakings have their individual systems of maintenance. A really efficient system is one of the finest institutions a gas undertaking can have. It forms a friendly link between the consumer and the undertaking concerned. A consumer who is on the "Maintenance Scheme," and has his lighting fittings and gas appliances periodically inspected and adjusted by a competent fitter, feels relieved of a great responsibility. He is more than pleased because this special service relieves him of the often irksome duty of having to clean lighting burners, which few people take to in a kindly spirit. Now he has better service with no trouble and no more expense.

Moreover, maintenance gives the gas undertaking an opportunity of keeping houses, shops, public buildings, &c., well equipped with the latest and best in lighting fittings. Also, when an improvement in heating or a new gas fire is thought necessary, suggestions from the maintenance fitter or his superior are often welcome, and are given consideration by the consumer, and such suggestions are sooner or later agreed to, to the mutual advantage of both.

I am of the opinion that it is essential and beneficial for a maintenance inspector or foreman to call now and again at places where maintenance is undertaken, to ascertain if satisfaction is being given by the fitter in attendance. It also gives him an opportunity of seeing if the fitter is doing his work correctly.

It has been found that consumers do not take kindly to frequent changes of men calling at their houses, and we often have requests that Fitter So-and-So shall call, and no one else, as he knows the house and where to find the lights and gas appliances without guidance. Such requests, to my mind, should be treated with the utmost respect, and if it costs a little more in extra time, and perhaps some inconvenience, it is advisable to comply with the request wherever possible. Such compliance increases the goodwill of the consumer towards the undertaking.

We have recently revised and, I think, improved our system of maintenance, and new forms have been sent to old customers to read over, and sign a slip attached, to say that they agree to the new conditions, and, at the same time, to state if they have hitherto found maintenance of gas lighting and appliances has been satisfactory. A very large number of replies have been received expressing genuine satisfaction and general appreciation of the work done in their houses. Thus we feel that all these consumers are good friends, and so long as we continue to give them good service, so long shall we retain them as gas consumers.

Discussion.

Mr. J. W. WHIMSTER (Engineer and Manager of the Bath Gas Company) extended a hearty welcome to the members, and congratulated Mr. Willmer upon his excellent paper. He stated that much importance was attached to the maintenance scheme, which had lately been re-organized, and had brought in many appreciative letters from consumers. There is no doubt that if consumers are satisfied with their existing apparatus they will certainly instal more.

Mr. J. T. SPENCER (President of the Association) stated that the point of working with the builder had been stressed, but would it not be more advisable to be closely in touch with the architects? Was any free fitting work carried out at Bath?

Mr. T. B. ARMITAGE (Cheltenham) observed that the speculative and small builders should also be taken into account. They seldom had working plans, and, therefore, it was advisable to offer certain advantages to this type of builder. Was the lime deposit in the water heaters cleaned out free in the maintenance scheme?

Mr. A. BARRETT (Frome) asked for particulars of the maintenance scheme with reference to the cleaning of cookers.

Mr. A. W. CULLINGTON (Stroud) proposed a hearty vote of thanks to Mr. Willmer.

Mr. S. S. J. LLOYD (Weston), seconding the proposition, emphasized the need for salesmen to understand their appliances. In the maintenance scheme, were there special men for different appliances?

Mr. W. M. PATERSON (Bath) explained that lighting burners were examined every ten weeks, and gas fires about twice a year.

Mr. WILLMER, in reply, said that he agreed with the necessity of keeping in touch with the architects of new houses. No free fitting work was carried out at Bath. The cleaning of cookers, and of lime deposit from water heaters, was only done at a charge to consumers. Specialized men were employed on the maintenance scheme for the dismantling of apparatus, but adjustment of burners was carried out by ordinary maintenance men.

USES OF A PORTABLE CALORIMETER IN THE RETORT HOUSE.

By G. G. BUTTERY, Assoc.M.Inst. Gas E.

[Paper before the Midland Junior Gas Association in Birmingham, Dec. 12.]

At the works with which I am connected, there are two benches of horizontal retorts, four ranges of vertical retorts, and six carburetted water gas machines. The horizontal and vertical gas join together in the purifying plant, and so it is not known what quality of gas is being made in each section or in any particular range. We were required to give a figure of the quality of the gas being made at the same time in different sections of the carbonizing plant, but at that time we had no method of testing crude gas for calorific value at more than one place at a time. We had a crude gas sampling and purifying machine, but that was not easily portable, nor was it always desirable to bring the gas by pipes to the apparatus; and then it would only be used for one gas at a time. Several other methods have been tried, among which mention may be made of calorimeters of the explosion type. In these, a measured quantity of gas, mixed with air, is exploded, and the explosion heat is measured by the expansion of a special liquid. This expansion, when applied to a simple calculation, gives the calorific value. The apparatus was not found suitable, chiefly because it was necessary to have a good idea of the result before it was done, in order to regulate the quantity of gas and of air for the explosion. For our purpose in testing crude gas, a water flow calorimeter, such as I have the privilege of demonstrating to-night, was used, and the following method devised.

THE APPARATUS.

The apparatus consists of:

(1) and (2) A water-flow calorimeter such as that supplied by the Sigma Instrument Company and a 1/10th c.ft. gasholder which acts as a meter. Needle valve governors are fitted at the inlet of both parts.
(3) A measuring cylinder graduated up to 1000 c.c.
(4) A 15-litre aspirator bottle to collect the sample of gas.
(5) Another 15-litre aspirator bottle or suitable vessel, for the purpose of holding sufficient water to displace the gas from the test bottle.
(6) A 5-litre aspirator bottle or bucket to supply water to the calorimeter.

For convenience while testing, the calorimeter is kept burning on town gas, the service being teed on either before or after the 1/10th c.ft. holder. The 15-litre aspirator gas sample is placed on the floor and connected from the tee piece to the inlet of the small holder, but still kept shut off. The bottle of water for displacing the gas is placed about 5 ft. above it, and connected by large glass and rubber tubing to the bottom of the gas sampler, carefully displacing any air-bubbles, so that the connecting tubes are full of water. Pressure is created within the gas sampler by turning on the water from the reservoir above.

The rate of water flowing through the calorimeter is set by a suitable size of jet at the inlet, so that with a rise in temperature of 12° to 15°, from the inlet water-temperature, just less than 1000 c.c. of water will pass into the measuring cylinder during the combustion of the 1/10th c.ft. of gas.

The volume of gas in the gasholder is indicated by a scale on the upright; and, leaving sufficient gas in the bell to keep the burner alight, the town gas is shut off. Then, by opening and shutting several times the pinch clip on the connection from the aspirator, the gasholder and calorimeter connections are cleared with the gas under test. With different qualities of gas, the change is readily noted by the alteration in the outlet thermometer reading. Being satisfied that the services now contain the gas under test, the gasholder is then filled, lifting the bell high in the water above the zero mark.

Shut the inlet cock to the holder, and, as the bell falls, switch the water into the measuring cylinder when it reaches the zero mark. Observations of the inlet and outlet thermometers are taken at equal intervals corresponding with the scale on the upright. When the bell reaches the 10th division mark, switch the water back to waste, and turn on the gas to refill the holder. For quicker working, clearing the connections, and filling the bell, it is usual to by-pass the first governor, and pass the gas straight into the holder. Filling the holder through the governor usually takes four minutes.

The calorific value is calculated from the formula:

$$\frac{\text{Rise in temperature °C.} \times \text{grammes water} \times 3{\cdot}968}{\text{Gas volume} \times \text{correction factor}} = \text{°B.Th.U. per c.ft. at 60° Fahr. and 30 in.}$$

No correction is usually made for humidity in this test.

It is possible to get four C.V. tests out of a 15-litre gas sample, but, due to varying circumstances, only two or three are usually obtained, and the duplicates are within ± 0·5 p.ct. A gas sampling bulb is usually fitted in the system and a sample taken for gas analysis.

As many as six samples of crude gas (*i.e.*, one from each of four ranges of vertical retorts and two benches of horizontal retorts) have been tested in one batch for calorific value and gas analysis (Tests No. 1). All parts of the apparatus are carefully checked before use. The thermometers are of a standard pattern and checked every 2° up to 40° C. The measuring cylinder is checked to correct weight of water at 15° C., and the volume of the bell is confirmed. The crude gases sampled contain up to 50 grains of tar per c.ft., but so far no trouble has been experienced with clogging of the needle valve in the governor.

EXAMPLES OF THE USE OF ASPIRATOR SAMPLES.

The method has been used for testing the quality of the gas at succeeding stages of the cooling, condensing, and purifying plants.

On one occasion, it was necessary to shut down one range of retorts, but as the other ranges were still working, and it was impossible to isolate the burning-off gas, the gas from this range was tested by collecting quick (*i.e.*, half-hourly) aspirator samples, and tested until the quality was too poor to mix with the ordinary gas stream, and so was blown into the air. (Test No. 4.)

At another time, when alterations were being made to certain valves in connection with the gasholders, and gas making had to be practically stopped for a few hours, half-hourly aspirator samples were collected continuously over the period and tested, so as to indicate the quality of gas being made, so that there would be no change in the quality before and after the period of the temporary shutting-down. Also, the quality of the gas has been tested when working the retorts at different pressures in the foul main. (Test No. 5.)

The calorific values obtained of the crude gases are slightly lower than those of purified gas, due to the impurities still in the gas, but compare favourably with figures obtained in the laboratory on pure gas. (Test Nos. 2 and 3.)

Test No. 1.

Gas Making Plant.	CO_2.	HC.	O_2.	CO.	H_2.	CH_4.	N_2.	Calorific Value, B.Th.U. Gross.			
								Actual.			
Horizontal No. 1, 16 beds	2·9	2·6	0·2	7·3	..	..	6·4	542 541 542	542	549	
,, No. 2, 16 beds	3·8	2·7	0·1	8·3	..	..	5·3	553 556	555		
Vertical No. 1, 32 retorts	5·4	1·6	1·5	15·0	..	..	11·2	426 426 419	424		Estimated C.V. of mixed gas, 456
,, No. 2, 30 retorts	4·6	1·5	0·9	16·2	..	..	6·5	423 421	422	Per 112 retorts 422	
,, No. 3, 26 retorts	5·2	1·7	0·8	14·8	..	..	9·1	417 418	418		
,, No. 4, 28 retorts	5·0	1·3	0·9	16·8	..	..	10·6	426 424 424	425		
Purified gas (mixed)	3·7	1·9	0·9	14·2	49·7	19·7	9·9	463 (Calculated from analysis, 457)			

Test No. 2.

Gas Making Plant.	CO_2.	HC.	O_2.	CO.	H_2.	CH_4.	N_2.	Calorific Value. B.Th.U. Gross.
Vertical No. 1, 30 retorts . .	4·9	1·7	0·7	15·5	..	..	5·5	Actual. 468 468
,, No. 2, 30 retorts . .	3·9	1·6	0·2	18·6	..	..	3·7	464 } 467
,, No. 3, 26 retorts . .	4·4	1·4	0·4	16·5	..	..	5·8	469 } 462 Average, 463
,, No. 4, 26 retorts . .	4·7	1·4	0·3	17·5	..	..	6·3	461 } 462
Collecting main from the 4 ranges, 112 retorts	4·5	1·6	0·2	17·4	..	..	5·0	455 } 455
								455 } 455
								469 } 468 Purified gas, 471
								468 } 468

Test No. 3.

Gas Making Plant.	CO_2.	HC.	O_2.	CO.	N_2.	Calorific Value. B.Th.U. Gross.
Vertical No. 1, 28 retorts . .	6·0	1·0	0·5	15·6	6·0	Actual. 450 } 453 } 451
,, No. 2, 16 retorts . .	6·5	1·8	0·7	11·5	5·7	449 } 483 484 487 } 484 Per 70 retorts, 466
,, No. 4, 26 retorts . .	6·3	1·4	0·3	12·4	5·8	480 } 472 473 } 471
Purified mixed gas, 70 retorts .	..	..	..	..	..	468 } 461

Test No. 4.

Gas Making Plant.	CO_2.	HC.	O_2.	CO.	N_2.	Calorific Value. B.Th.U. Gross.
Shutting down gas, 1st sample .	..	..	..	..	..	Actual. 308 } 307 (Town gas spot test in retort house, 475)
,, ,, ,, 2nd sample.	4·3	0·4	0·3	21·8	24·2	306 } 302
						302 } 302

Test No 5.

Gas Making Plant.	—	Calorific Value. B.Th.U. Gross.
Vertical No. 4	With 15/100 in. pressure at governor.	Actual. 488 } Usual range pressure = $\frac{10}{100}$ in.
,, No. 4	,, 5/100 in. ,, ,, ,,	453 }

SUMMARY.

The calorimeter has the advantage of—

(1) Small gas and water consumption.
(2) Elimination of the meter—no meter checking or misreading of volume.
(3) No possibility of change of gas during test.
(4) Ease of taking ten readings over the graduated scale.

It has the disadvantage of—

(1) No proper provision for obtaining the temperature of the gas.
(2) The flame extinguishing itself when the 1/10 c.ft. of gas has burned.

The method and the apparatus can be used anywhere on the works. The apparatus has the advantage of being very compact and easily assembled, the only requirements being a supply of water and gas. In fact, the apparatus was first fitted up and the method used successfully in a very dirty and dusty place just under the roof of the retort house, near the coal handling plant. The method was afterwards checked under better conditions in the laboratory on town gas and found to give similar results to a Junker or a Boys calorimeter.

Results have been obtained over a wide range of quality from 300 to 560 B.Th.U. gross, and the calorimeter readily adjusts itself to the gas under test. By this method very useful approximate figures of quality have been obtained, which information is of great value in balancing and controlling the quality of gas made in the various parts of the carbonizing plant.

Discussion.

The CHAIRMAN (Mr. A. R. Myhill) moved a vote of thanks to Mr. Buttery; and this was seconded by Mr. F. J. BENGOUGH (Nechells Works, Birmingham), who expressed the view that the calorimeter was more fool-proof than most of the apparatus of the gas analyst. The method of testing strongly appealed to him.

USES OF THE BOMB CALORIMETER.

A paper bearing this title was then read by Mr. J. N. SHORROCK, M.Sc., of the Birmingham Gas Department, to whom a vote of thanks was passed on the proposition of Mr. C. F. TOOBY (Coventry), seconded by Mr. W. L. S. SPINKS (Birmingham).

CORRESPONDENCE.

Edinburgh Waterless Gasholder.

SIR,—I have read Mr. Gracie's reply to my letter, Nov. 30, with feelings of disappointment, especially in view of the conflicting opinions that prevail concerning the economy and utility of this type of holder; and as the various statements concerning the above holder were publicly made and reported in the Technical Press, I venture to suggest to Mr. Gracie that the information he offers to send me in reply to my questions would be more appropriately communicated through the medium of the "JOURNAL," so as to receive the same publicity as his original observations.

"NEW AGE."

Dec. 21, 1929.

Complete Gasification at Mill Hill.

SIR,—I was interested to read the letter from the Regenerative Coal Gasification System, Ltd., which appeared in your issue of Dec. 11.

I have no intention whatever of being drawn into a lengthy discussion on this subject in the Press, but I feel I must point out the inaccuracy of the statement made that during the "up-run" period the "gas generated from the coke does not pass through the coal chamber." In my paper it is made perfectly clear, both in the text and in the diagram, that all the "up-run" gas does pass through the coal chamber.

With regard to the other points raised, the best answer to these appears to me to be that, irrespective of theoretical considerations, two of these plants are successfully operating side by side at my Company's Works, completely gasifying coal and working 24 hours per day—in other words, "the proof of the pudding is in the eating."

F. J. PEARCE,
Works Manager.

Gas-Works, Mill Hill, N.W.7.
Dec. 18, 1929.

REGISTER OF PATENTS.

Charging of Gas Generators.—No. 320,853.

HUMPHREYS & GLASGOW, LTD., and STELFOX, J. C., both of Victoria Street, S.W. 1.

No. 18,121; June 22, 1928.

The object of this invention is to enable the amount of coke or its equivalent necessary to be fed at a time into a generator or the like to be introduced into a valve-closable charger from a bulk supply in a simplified manner, the feature of importance being that not only is no dependence placed upon the rate of flow of the material and the period during which the inlet valve to the charger remains open, but that no device employed to arrest flow of the material ever requires to cut through more than a relatively thin and consequently easily displaced layer of the material.

To this end there is combined with a valve-closable charger a chute leading to the charger from the bulk container; the disposition of the chute and of the discharge opening of the container in contradistinction to the disposition of other combinations being such that when the amount of material corresponding to a charge has passed a pre-determined point, the material comes to rest, leaving only a relatively thin layer to be cut through, dislodged, or jammed by any device employed to prevent further flow of the material.

Gas Washer.—No. 321,252.

NORGATE, R., of Deal.

No. 23,955; Aug. 20, 1928.

According to the present invention a mixture of water or liquor and high-pressure gas is ejected as a fine spray or mist into the washing chamber from a fixed ejector. Apparatus made according to the present invention comprises one or more fixed ejectors and one or more washing chambers.

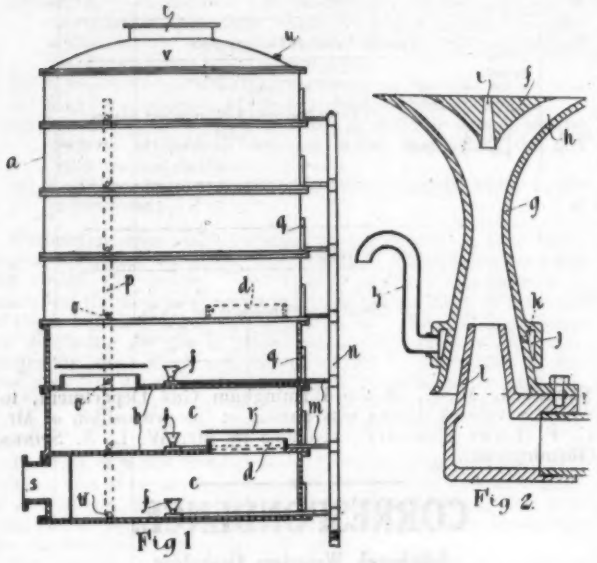


Fig 1

Fig 2

Norgate's Gas Washer.

Fig. 1 is an elevation, partly in section, and fig. 2 is an enlarged sectional detail view of the ejector.

The apparatus consists of a cylindrical casing *a* divided by horizontal plates *b* into seven washing chambers *c*. Communication between adjacent chambers *c* is established by means of apertures *d* in the plates *b*. The construction of the ejector *f* is shown in detail in fig. 2, from which it will be seen to comprise a venturi-like casing *g*, closed at top with the exception of an annular slot *h* near the periphery, and a central channel or hole *i*. The base of the casing *g* is formed with a jacket *j* communicating with a bent pipe *z* and with the interior of the casing *g* by means of a port *k*. A nozzle-like member *l* projects into the base of the casing *g*, the other end of the nozzle being turned at right angles and engaging by means of a threaded joint with a pipe *m*, communicating with a vertical pipe *n*. Each chamber *c* is in communication also by means of pipes *o* with another vertical pipe *p*. Further, each chamber *c* has a door *q*. Shields *r* are adapted to cover the area of the holes *d*. Gas inlet *s* and gas outlet *t* are disposed at the base and at the top respectively of the casing *a*, and a water inlet *u* is provided in the cover *v* of the casing *a*.

The apertures *d* of the various chambers *c* are staggered relatively to one another, or they may be arranged zig-zag fashion.

In operation the apparatus functions as follows: High-pressure gas (say, about 5 lbs. per sq. in.) is supplied to the nozzles *l* from the pipes *m*, *n*; water is admitted to the casing *a* through inlet *u*; and the gas to be washed is admitted at the base of the apparatus through the inlet *s*. The gas ejected under pressure from the nozzle *l* mixes with water or ammoniacal liquor formed by intimate contact between the gas and water, which enters the ejector through the annular passage between the nozzle *l* and the member *g*; and the mixture thus formed is blown in a more or less atomized state in the chamber *c*. Thus a dense mist is formed in the latter, giving a large area of contact between the gas to be washed and the atomized mixture. The clean water entering through the inlet *u* flows in very slowly, and passes successively through each chamber *c* by way of the apertures *d*, and runs out from the bottom chamber *c* through the outlet *w*. The spray is prevented from falling directly through the apertures *d* by reason of the shields *r*. Liquor may be drained off from the bottom of the chambers *c* through pipes *o* which communicate with the common pipe *p*. The curved ends of the pipes *z* are above the water level in the chambers *c*, and gas in the washing chambers *c* is drawn through the pipes *z* into the jacket *k*, and thence through the port *k'* into the ejector *f*, where it mixes with the liquor and pressure gas, and is again expelled into the chambers *c*. This helps to produce a more efficient atomization of the liquor.

Gas Valves.—No. 321,293.

KEMPTON, C. H., of Westminster Bridge Road, S.E. 1, and BISSELL, W., of Warwick.

No. 28,482; Oct. 4, 1928.

This invention refers to gas cocks or valves for use in connection with heating stoves and the like. There is provided a regulating cock of simplified construction whereby the gas, and, therefore, indirectly, the air, supplied to a heating stove or fire may be controlled in a more efficient manner by the simple adjustment of one operating handle.

The device comprises a somewhat **T**-shaped body portion forming a tapering cylinder or casing for a rotatable conical plug. The plug is made hollow and is also provided with an elongated radial or lateral opening adapted to co-operate with an inlet opening or bore communicating with the gas supply pipe. Arranged at the end of the plug casing and at the smaller end of the plug is a screw-on cap which is provided with a plurality of small openings through which the gas is adapted to pass to the burners by way of the mixing tube; the gas passing radially through the opening in the side of the casing and down into and out of the axial bore in the plug. For regulating the supply of gas, means are provided for determining the number of holes through which the gas may emerge. On the inside of the perforated cap is a split ring or washer, which is helically formed so that in its normal or "open" position it leaves exposed the circumferential or other ring of holes with which it co-operates, and when closed or pressed tightly on to the inside of the perforated cap, it will gradually, one by one, and then completely, close the openings.

For pressing the circular ring or washer home into the inside of the cap is an inclined cam-like surface on the end of the plug; and between the surfaces and the washer is an axially sliable but non-rotatable cam ring which is adapted, as the plug is turned, to be moved endwise, so as to press the washer into close engagement with the interior of the perforated cap. There are means for preventing rotation of the intermediate cam ring.

Producer Grate Bars.—No. 321,486.

DRAKES, LTD., and DRAKE, J. W., both of Halifax.

No. 24,896; Aug. 30, 1928.

This invention relates to producer grates of the kind in which cooling is effected by supplying water to grooves in the grate bars. The object is to form the grate bars of such a shape and construction that, while retaining or increasing the strength, they are made to afford more freedom for the inflowing of air to the furnace. This is secured by the grooves in the grate bars having their side walls approximately parallel to each other. This form of grate bar, state the patentees, affords better facilities for water to be circulated to retain them at a lower temperature and prevent them from being excessively heated than is the case with those as heretofore constructed, by reason of the grooves as they form them being prevented from being choked.

Where grate bars having grooves with their side walls parallel to each other have heretofore been proposed, there has not been provision made for the flowing of water throughout the lengths of the bars.

Oxide Purifier.—No. 321,536.

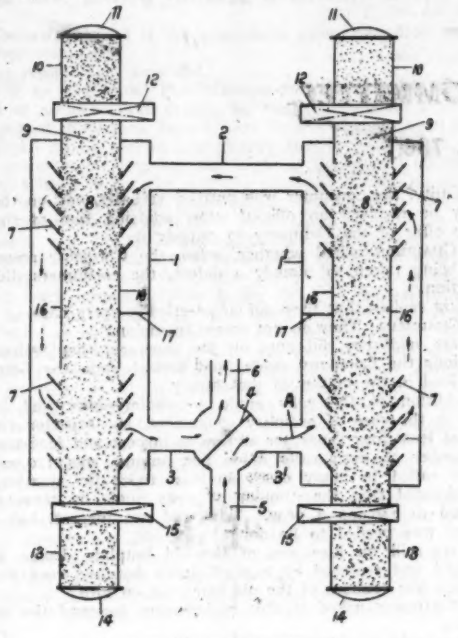
WILSON, W., of Burton-on-Trent.

No. 31,041; Oct. 26, 1928.

This invention relates to apparatus for the purification of gas of that type in which the gas is passed and repassed transversely through a travelling column of oxide; the oxide descending a structure located within a chamber provided with baffles. It is illustrated diagrammatically in the accompanying drawing.

The apparatus shown comprises a pair of upright chambers 1, 1^1 interconnected near their upper ends by a conduit 2 and fitted near their lower ends with conduits 3, 3^1 respectively connected to a change-over valve 4 to the casing of which are adjoined connections 5 and 6, one of which serves as a foul gas inlet, and the other as a clean gas outlet. Within each chamber is disposed a vertical louvred structure composed of vertically spaced inclined or dish members 7 defining a vertical passage 8 adapted to receive fresh oxide 9 admitted to the passage through a gas lock surmounting the relative chamber and including a compartment 10 contained between a sealing lid 11 and a valve 12. The spent oxide is discharged from the pass-

age 8 through a gas lock at the bottom of the relative chamber and including a compartment 13 contained between a sealing cover 14 and a valve 15. About midway of the height of the passages 8, continuous plates 16, adjoined by baffle-plates 17, are fitted.



Wilson's Oxide Purifier.

In practice, foul gas admitted at 5 flows as indicated by the arrows A by way of the valve 4 and connection 3^1 into the chamber 1^1, transversely through the lower half of the column of oxide therein, upwardly and transversely through the upper half of the column through the conduit 2 to the chamber 1, transversely through the upper half of the column of oxide in the chamber 1, and downwardly and transversely through the lower half of the same column; the gas, now cleaned, issues by way of the conduit 3, valve 4, and connection 6.

When sulphuretted hydrogen appears in the gas passing through the conduit 2, the valve 4 is changed over and the direction of flow of gas is reversed so that the oxide which is most contaminated is revivified by the oxygen component of the cleaned gas.

Safe Gas Valves.—No. 321,542.

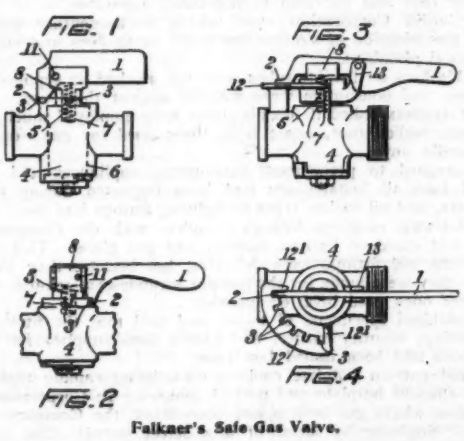
FALKNER, A. J., of Dunmow.

No. 32,082; Nov. 3, 1928.

This invention relates to improvements in gas valves of the kind in which a handle is pivoted to the plug and has a detent on it that normally engages, under spring action, with one or two or more recesses to hold the plug against turning unless the handle is rocked on the pivot to free the detent.

The spring means is disposed axially of the plug, and the handle is pivoted to the plug to one side of the axis. The spring means may be in the form of a rod or plunger, and the sides of the recesses and the detent may be inclined, and the detent may be in the form of a spring-urged ball.

In the examples illustrated, the handles 1 of the valves have a detent 2 which is urged into engagement with either or any one of two or more recesses such as 3 in the valve body 4 by a spring 5 disposed axially of the plug 6 (where shown) and within a bore 7.



Falkner's Safe Gas Valve.

In fig. 1, the stem 8 of the plug is slotted to receive the end of a handle of lever form. The lever is pivoted to the stem at 11, and at a point between the detent and the spring in such a manner that the free end has to be depressed before the plug can be turned.

In fig. 2, the arrangement is somewhat similar to that shown in fig. 1, and like reference numerals indicate like parts; the difference consists in arranging the detent intermediate the ends of the lever so that the lever has to be pulled upwards before the plug can be turned.

In figs. 3 and 4, the recesses are provided in a rack 12 fixed to the valve body, and the handle of lever form is pivoted on lugs 13 carried by, and rotatable with, the plug stem. The lever has to be pulled upwardly to disengage the detent and rack; and the detent may have a wedge-shaped edge to facilitate re-engagement. The extreme teeth 12^1, 12^1 of the rack are longer than the intermediate ones, and limit the maximum turning movement of the handle to 90°.

Electrical Gas Cleaning Apparatus.—No. 321,571.

LODGE-COTTRELL, LTD., of Birmingham.

[A communication by the METALLGESELLSCHAFT AKTIENGESELLSCHAFT, of Frankfurt-on-the-Main.]

No. 34,904; Nov. 27, 1928.

This invention relates to a method of cleaning the electrodes in apparatus for the electrical precipitation of suspended particles from gaseous fluids by jarring such electrodes in order to dislodge the material deposited thereon. It aims at transmitting the blows or jarring impulses to every part of the electrode. To this end, the electrode is articulated to a single point of suspension in such a way that vibrations imparted thereto by a blow can extend freely throughout the electrode and die away freely, and in which the jarring of the electrode is effected in the vicinity of the point of suspension.

The invention is applicable equally well to plate-type electrodes and to strip or lattice types, irrespective as to whether they be discharge or collecting electrodes. Should the electrode not be constructed as a single plate or surface which can easily be suspended from a single point, but consist of rods, lattice, strips, or screens, then the rods or strips are mounted in a frame which is suspended in the manner described, and the shaking or jarring is imparted to the frame.

The rapping may be carried out in any desired manner—for example, by hand, or mechanically and/or automatically.

Centrifugal Fans.—No. 321,847.

JAMES KEITH & BLACKMAN COMPANY, LTD., and KEITH, G., both of Farringdon Avenue, E.C. 4.

No. 35,166; Nov. 29, 1928.

This invention relates to improvements in centrifugal fans or blowers, being more particularly applicable to high-pressure fans. For fans in which the diameter of the impeller is large in relation to its breadth, loss of efficiency due to departure from the vortex law may be obviated or minimized by the invention, according to which the increment of cross-sectional area is obtained by adoption of a modified form of volute casing, which may be conveniently termed quasi-volute, and arranging for the fan runner to discharge side wise into the casing.

Electrical Gas Cleaning Apparatus.—No. 321,869.

LODGE-COTTRELL, LTD., of Birmingham.

[A communication by the METALLGESELLSHAFT AKTIENGESELLSCHAFT, of Frankfurt-on-the-Main.]

No. 38,189; Dec. 27, 1928.

This invention provides a slotted collecting electrode for electrical precipitating apparatus, in which the collecting surface is composed of a plurality of independently suspended strips which are adapted to be jarred independently of one another.

The strips constituting the collecting electrode may be arranged transversely, and be suspended from points outside their centre of gravity in such a manner that they are prevented from assuming a position in accordance with gravity by their upright members. Alternatively the strips may be independently suspended in a vertical direction from points outside their centre of gravity, and may rest with their lower ends against a movable striking rod, so that a blow delivered to the rod will be transmitted to each strip, imparting to it a wave-like motion travelling upwards from the lower end to the point of suspension.

APPLICATIONS FOR PATENTS.

[Extracted from the "Official Journal" for Dec. 11.]

Nos. 36,811—37,642.

ATKINSON, J. S.—"Generation of producer gas." No. 37,161.

CHANDLER, D.—"Incandescent gas lamps." No. 37,535.

CHANDLER, D.—"Superheaters for incandescent gas lamps." No. 37,536.

FALK, STADELMANN, & CO., LTD.—"Ignition devices for gas fires." No. 37,623.

GAUTRON, L. G.—"Automatic electrical ignition mechanism for gas stoves." No. 37,193.

PORRET, H.—See Gautron, L. G. No. 37,193.

SOUTH METROPOLITAN GAS COMPANY.—See Chandler, D. Nos. 37,535, 37,536.

STEELE, H.—"Gas-fired ovens for manufacture of tiles, &c." No. 37,544.

STEIN & ATKINSON, LTD.—See Atkinson, J. S. No. 37,161.

MISCELLANEOUS NEWS.

GAS POISONING COMMITTEE.

[Continued from p. 786.]

Last week we gave the evidence of Mr. Stephen Lacey at the sitting of the Committee on Dec. 12. This was followed by the evidence of Mr. H. D. Madden.

MR. MADDEN'S EVIDENCE.

Mr. *H. D. Madden*, M.Inst.C.E., M.I.Mech.E., Past President of the Institution of Gas Engineers, a Member of H.M. Fuel Research Board, and Chief Engineer and Manager to the Cardiff Gas Light and Coke Company, gave evidence as to the practice at Cardiff and the precautions taken to prevent accidents, not merely by providing an efficient organization for inspection and for the stopping of leakages when they occurred, but by ensuring as far as possible against their occurrence by using, and encouraging the consumers to use, really efficient apparatus.

The Cardiff Company, he said, supplied gas over an area of some 68 square miles to 56,000 consumers, of which 26,000 were supplied by prepayment meter. All materials and apparatus issued for use in consumers' premises received the closest scrutiny before and after fixing, and only high-class material was utilized for these purposes. All internal tubing used was of the solid drawn type, and of robust nature. In regard to tubes, downrods, &c., the makers supplied to guarantee—e.g., pendants and downrods for lighting points were guaranteed to have been tested under a pressure of 8 to 9 lbs. per sq. in., and a statement to this effect was stamped on each tube.

In reply to the Chairman (Sir Evelyn Cecil), Mr. Madden said he was satisfied that in all these cases the materials supplied were up to the guaranteed standard. Furthermore, all apparatus sent to the Company's central workshop for overhaul and repair was tested very carefully by an assistant foreman, who marked it when it had been passed, and was ready for the final painting or lacquering process. All fitting and carcassing work done by the Company was carried out by experienced and skilled fitters, and was inspected, when completed, by skilled foremen. Builders' work was also inspected. About 96 or 97 p.ct. of the gas fitting done in Cardiff was carried out by the Company's staff. The latter had opportunities for inspection; and if they found anything done by local fitters which was not considered to be up to the proper standard, the Company always advised the consumers as to what ought to be done.

In reply to a further question, he said there was very little "amateur" gas fitting.

Arrangements were made with builders for carcassing new houses, &c., to the Company's specification. The installation must be inspected and passed by the Company's foreman before the free service was laid. The pipes had to be obtained to specification, and they were not sealed up until the Company's foreman had passed them.

Mr. Madden also emphasized that it was essential that the personnel employed to fit the materials should be of the highest grade; every endeavour was made to attract recruits of good average education and to train them to be sound thinking men and efficient craftsmen, considering "consumers' service and satisfaction" as the ultimate goal.

The gasfitters' staff personnel (indentured apprentices) were carefully selected from secondary schools, and trained. They attended technical college two afternoons per week in the winter; the Company paying the fees, giving them the necessary time, and paying them for that time, and also providing a number of special prizes. The students were taught, in addition to gasfitting, the elementary stages of physics, mathematics, chemistry, and workshop drawing. The course was really a five years' course, and the Company worked in conjunction with the Cardiff Technical College.

Salesmen's staff and the staff of inspectors, &c., were recruited from such trained men, after they had completed their indentures and had served as fitters for several years. The Company arranged special internal lectures and demonstrations for inspectors, fitters, &c., engaged on consumers' service. Regular demonstrations and lectures were given in the Company's physical laboratory, especially on the introduction of any new apparatus for issue to consumers.

The CHAIRMAN asked if new apparatus was introduced fairly frequently.

Witness replied that it was.

The CHAIRMAN: You are constantly making improvements?

Witness: Yes.

He added that no new type of appliance was put on sale unless thoroughly tested and approved by physical laboratory tests and passed by District Superintendent and Engineer.

Dealing further with the opportunities for training available to the staff, he said that membership of the Junior Gas Association of the district, and of the Salesmen's Circle—the work of which was partly technical—was open to them.

With regard to ordinary consumers' appliances and fittings, he said that a system of maintenance and inspection had been established for several years, and a card index was taken of all appliances, &c., in each consumer's residence. The Company's staff immediately remedied minor defects which they might discover on their calls; but, if any apparatus belonging to the consumer were found faulty, the consumer was notified verbally, and on the following day he received an official letter advising him of the defect, and the offer of the Company to remedy it.

The CHAIRMAN asked whether, when the Company recommended action being taken to remedy a defect, the consumers did in fact take action.

Witness replied that they did in practically every case.

The CHAIRMAN: They do not resent intrusion?

Witness said they did not; on the contrary, they welcomed any suggestions the Company made, and looked upon the Company as their friend in the matter of gas supply.

In addition to the calls made by maintenance and inspection officers in the case of ordinary consumers, an inspector visited the houses at least four times per annum to inspect and read the meters. The number of such calls made per annum was 120,000. The collector called in many cases at least twice per quarter, and it was estimated that the number of calls made by these collectors amounted to 240,000 a year. They did not inspect, but asked if anything was needed to be done.

Cookers still on hire and of the old hotplate design had been exchanged and replaced by high-efficiency hotplate cookers. There were very few cookers of the pre-war type on hire.

The CHAIRMAN asked if that replacement lessened the danger of accidents.

Witness said it did, because everything in the new cookers was modernized. They were more economical and of better construction than the pre-war cookers.

WATER-SLIDE CHANDELIERS.

There was some discussion with regard to water-slide chandeliers. Mr. Madden said that, where they were found to exist, a letter was written by the Secretary of the Company to the consumer, pointing out the danger of such fittings and offering to alter them or renew them at less than cost. In some cases the Company had offered to do this for nothing rather than that they should continue to be used. The Company had followed this policy for the last fifteen or twenty years, so that the number of such chandeliers existing in their district at present must be very small.

The CHAIRMAN, quoting from the Board of Trade Returns of cases of gas poisoning, said that in 1922 there was none due to that cause; in 1923, 1924, and 1925 there was one in each year; in 1926 and 1927 there were two in each year; in 1928 there was one; and in the first seven months of 1929 there were six. He asked if frost might have had anything to do with this sudden increase in 1929.

Witness replied that, during the abnormally cold weather experienced in February of this year, anything in the nature of water in the houses would freeze, and he was rather inclined to think that in these older chandeliers the water might have frozen and might possibly have broken the inner tubes. He did not think any water-slide chandeliers had been made for 25 years, so that any that were in use must be very old. If a consumer in the Cardiff Company's area would not have such a fitting exchanged, the Company offered to make it a fixture instead of a slide, so that there was no water in it, and it became virtually a solid down-rod.

The Company would not fit geysers or fires without a proper fluepipe, and ventilation—"Uralite" material being used for flues for geysers and hot water apparatus.

Specimens of the "Uralite" materials were exhibited, and, replying to a question as to their cost, he said it was about twice that of metal, but in every case they informed the consumer that they would fit that and not iron to hot-water apparatus.

The Cardiff Corporation were taking Parliamentary powers to enforce the adoption of similar conditions as to flues and ventilation by all local plumbers.

Portable fires on flexible tubes were not stocked or supplied by the Company, and consumers were warned against their use.

The CHAIRMAN asked if flexible tubes were employed much.

Witness replied that, apart from those used for gas irons, there were hardly any.

With regard to prepayment consumers' appliances and fittings, he said that all installations had been inspected during the past four years, and all earlier types of lighting fittings had been replaced by solid-drawn 19-gauge fittings complete with the Company's approved and standard burner, mantle, and gas globe. This was not because the old fittings were defective, but because they were out-of-date; they were made for the upright incandescent mantle, whereas the newer ones used inverted mantles.

He exhibited specimens of these, and said that the fittings complete (fitting, mantle, burner, and globe) were supplied for 2s. 6d., and 73,000 had been issued last year.

The old pattern hotplate cookers were being rapidly replaced by modern efficient hotplate and packed cookers. In Corporation housing estates where gas boilers had been fitted, the Company notified the City Engineer by letter of any defect noted. The collectors called ten times per annum on prepayment consumers to clear meters and take complaints; the number of such calls made per annum being about 260,000. Thus, the consumers had every opportunity

on frequent occasions to consult representatives of the Company, who were well known to them as the result of their periodical calls. It was a rule of the Company also that, whenever a fitter called to carry out work at consumers' premises, he must inspect the meter and main cock, greasing the latter if necessary to keep it free running.

The CHAIRMAN asked if the consumers often consulted the Company's representatives.

Witness replied that they did.

Asked if he had found that prepayment meters were more often a source of accident than others, he replied, "Not at all."

With regard to escapes, he said that reports of these were attended to by special motor service immediately they were received. There was an attendant on duty day and night at the central offices of the Company, with a motor car specially equipped for the purpose. He explained the organization provided for dealing with emergencies, by which co-operation was ensured at all times between the different departments and the principal officials. Immediately an escape was reported to any station, it was wired to central office, where the fitter on duty was given particulars as to the location, and he proceeded there immediately by motor car. If the escape occurred inside a house, he rendered it "first aid" or remedied it completely. If there were an escape outside, and gas was getting into the house, he communicated immediately with the nearest mains and service gang. (Every morning a list of the mains and service gangs, showing the positions at which they were working during the day, was sent to central office.) The gasfitters were provided with proper instruction cards, showing telephone numbers, the location of telephone posts, &c., and instructions as to how to act in the event of escapes. These booklets of instructions were issued to all fitters and staff officers dealing with consumers' service.

In reply to a question, Mr. Madden said that nearly all escapes on consumers' premises were minor, but every one was treated as a serious matter, and attended to as soon as possible.

There were five district offices, all connected by telephone, as were also the residences of the Assistant Engineer, the Superintendent of Mains, the Foreman Mainlayer, and several emergency fitters; and they were indexed under the Company's heading in the telephone directory.

The Superintendent of the Mains Department had a motor car fitted with emergency apparatus. The foreman mainlayer had a motor cycle and sidecar. For the Mains Department there was also a special motor lorry, fitted with emergency box and tools, to convey men and material rapidly to any spot at which they were needed, by day or night.

At this point, the Chairman, remarking that prevention was better than cure, asked Mr. Madden (as he has asked several other witnesses) whether it would be practicable to provide some contrivance which would indicate by means of a red light or by whistling (a whistling jet) that a tap had been turned on accidentally or had not been turned off properly. Mr. Madden replied that, if gas were escaping to any considerable extent through a burner, it would be heard in any case, and also that, if a whistling jet were attached, it would whistle the whole time the gas was on.

The CHAIRMAN suggested that it might be arranged so that if the gas was actually being burned there would be no whistle. He asked if witness would rule it out as impossible.

Witness said he would not like to suggest that anything was impossible. If there were anything practicable for indicating such leakages, the National Gas Council would examine it thoroughly. He assured the Chairman that the industry was always looking out for improvements. He added that on all accounts sent to consumers there was a notice that consumers should communicate with the Company if they detected the slightest smell of gas.

Considering further the organization for dealing with escapes, he said that at all ground openings for new services the existing mains were "barred" left and right, in order to find whether there were any escapes. Also, the Electrical Engineer's Department and the Gas Company had mutual working arrangements to notify each other immediately any defect was discovered. Staff meetings were held from time to time, and a close co-ordination of mains and outside work with internal house work was thereby ensured. All departments were equipped with electric lamps, gas masks, and special emergency kit for dealing immediately with escapes. The Chief Constable had arranged that the Company should be advised by telephone of all fires in the city and district immediately they occurred, so that gas supplies could be turned off. Also, he had given instructions that the Company's emergency van and cars should receive priority in traffic control.

SERVICE LAYING.

Discussing the policy with regard to services, he said they were wrapped and coated, and in poor ground they were laid in pitch or concrete-filled wooden troughs. Services capped off in houses were inspected from time to time, and, if not likely to be re-used, were plugged back at the main. The policy of service renewals was a continuous one, and the whole district was covered periodically for replacing defective or suspected pipes.

The work of renewing roads, on the part of the road authorities, had of necessity increased the number of service renewals; and these far outweighed the number of new services required.

The Company's arrangements were examined by many of the surrounding small undertakings, who were notified of the results of the work done in the physical laboratory, and they were putting into practice this general outline of schemes for safety and inspection purposes. These smaller undertakings were quick to take advantage of the results of the research and investigation conducted in the Company's physical laboratory, and they were assisted in this by reason of the fact that the Junior Gas Association and the South Wales and Monmouthshire Gas Salesmen's Circle held their meetings there periodically. Thus, the Cardiff Company acted as a centre whence the results of research and experiment were disseminated among the other undertakings in South Wales; and he added that the Institution of Gas Engineers and the British Commercial Gas Association, by means of their organizations, were enabled to secure a similar interchange of knowledge and experience throughout the whole country. After enlarging upon this work, he remarked he was intimately associated with both these bodies, and could say without hesitation that the remarkable freedom from accidental gas poisoning which this country enjoyed was due in no small measure to the work they had done.

Summing up, he said that, while the industry regarded the highest margin of safety in all gas fittings and appliances as of the utmost importance, he would respectfully direct the Committee's attention to the influences of outside forces which had caused responsible gas officials some anxiety. He referred in particular to the internal carcassing of buildings where in recent years so-called free installation, or deferred payment electric wiring, had been fixed. The gas industry considered that sufficient thought or care had not always been exercised by the many contracting wiring firms, and the gas pipe carcassing had often been injured, causing leakage, and in a number of cases fires, by the fusing of electric wires.

Asked if he knew of cases in which gas poisoning had arisen from this cause, he said he had not particulars of specific cases at that moment, but he knew such cases had occurred. There should be provision for the safeguarding of both supplies—*i.e.*, they should be kept at a safe distance apart under floors or in cellars—as a short-circuit and fusing might, in addition to causing a fire, cause a burn-out in the gas pipes, thus adding fuel to the fire. Even if no fire should ensue, the risk of gas poisoning became serious. With regard to the entry of services into houses, he said that the Company had agreed with the Electrical Engineer at Cardiff that cables and gas service pipes should not come through the same openings, because the cables were likely to fuse and burn or cause pitting, and eventually holes, in the cast-iron service pipes. There was also an arrangement whereby, if it were necessary for a cable and a gas service pipe to cross, an insulating brick or insulating material of some form was provided. (He exhibited to the Committee a number of examples of pipes which had been damaged by electric wires, and said he could produce 1¼-in. iron pipes which had been punctured similarly by electrolysis.)

Responsible gas engineers and electrical engineers agreed entirely with the principle that the Rules of the Institution of Electrical Engineers in regard to wiring should be enforced to safeguard consumers. He added that there were numerous cases of danger caused by electric wiring contractors severing and hammering up gas pipe carcassing, or damaging internal gas piping and partly remedying the damage, without giving notice. The Company would rather rectify this damage without payment than leave it.

Finally, he said the Committee could rest assured that the National Gas Council would be willing to co-operate with the Board of Trade in improving existing practice in gas supply; in fact, the industry would continue its endeavours in every way to improve its service to the community even if only as a matter of modern business principle. The industry, including the manufacturers of material and plant, was always prepared to receive suggestions for improving the methods of supervision now in operation, and provincial undertakings were as keenly alive to the importance of such supervision as were those in the Metropolis.

Mr. F. J. WROTTESLEY, K.C. (a member of the Committee), asked from whom the driving force in the matter of introducing new and improved fittings should be expected to come.

Witness replied that it should come from the gas undertakings mainly; and, in fact, it did.

Asked what steps were being taken to investigate the possibility of safety devices, he instanced, as a typical example, the work done at Watson House by the Gas Light and Coke Company.

In the "JOURNAL" for Jan. 1, 1930, there will be published the evidence of Mr. Albert Stokes, Joint Manager of the South Metropolitan Gas Company, given on Tuesday, Dec. 17.

Power from Sludge Gas at Birmingham.—The system adopted by the Birmingham Tame and Rea District Drainage Board for the generation of power from sludge gas has been very successful, and at a meeting on Dec. 13 in Birmingham, it was decided to enlarge the installation. The Board made their first practical experiment in the utilization of gas from sludge for power purposes in 1926, and two years later an extension of the equipment was made, the total expenditure at that time being rather more than £30,000. The original estimate was that it would be possible to produce 1½ million units of electricity per annum with a consequent saving of £2000 per annum, but the experience of the past two years' working showed that it would be possible to obtain an annual output of sewage gas sufficient to generate 2 million units of electricity with a largely increased saving. The Drainage Board point out that on the completion of the second bio-aeration unit, and on the electrification of sludge pumping operations, the consumption of current will reach 3 million units per annum. They are therefore installing the third gas engine and alternator. This engine will be of 400 B.H.P., the same size as one installed early this year, and the estimated expenditure on sets, switchgear, and foundations is £6250.

COLONIAL GAS ASSOCIATION.

Forty-First Annual General Meeting.

The Forty-First Annual General Meeting of the Colonial Gas Association was held at Melbourne on Wednesday, Oct. 9, 1929—Mr. P. C. HOLMES HUNT, M.Inst.C.E. (Chairman of Directors), presiding.

The CHAIRMAN, in proposing the adoption of the report and accounts, said: The revenue from the sale of gas has increased by £15,455, and miscellaneous revenue is higher by £5139, making the total revenue for the year £20,594 better than for the year ended June 30, 1928. The cost of coal and purifying has increased by £5480; wages, repairs, and depreciation by £3237; and administration by £434—a total of £9151. It will thus be seen that while the sales of gas have increased by nearly 5 p.ct., yet the expenses have not increased in as great a ratio. The revenue account, however, has been affected by the lower prices for residuals, and the returns from some of the recently acquired investments.

Bank and loan interest has decreased by £1083, while debenture interest has increased by £788. The balance at credit of the revenue account is £103,866, and, after deducting bank, loan, and debenture interest, the profit for the year is £84,037, comparing with £72,299 for the corresponding year. Owing to the increasing capital of the Company, the dividend payments are naturally growing. The interim dividend for the half-year to Dec. 31, 1927, was £24,536. For the half-year to June 30, 1928, the total was £31,269, while the interim dividend to Dec. 31, 1928, required £35,234. Allowing for the payment out of the year's profits of the last-named interim dividend, the profits available for final dividend are £62,896.

Referring to the assets, the amount expended to date on land, buildings, plant, &c., *less* depreciation, has increased by nearly £70,000 upon the figures of last year, representing expenditure on land for showrooms, portion of cost on a new gasholder at Box Hill, and the balance on mains, services, and meters for new business secured. The other assets call for no special comment, excepting the item "Investments at Cost," which now stands at £371,474—about £100,000 more than the figure at June 30, 1928.

SUBSIDIARY UNDERTAKINGS.

We find that in all towns where we have amalgamated with the gas undertakings there is considerable scope for the installation of appliances for cooking, and also for relieving other household work. During the twelve months under review additional cookers to the number of 483 were installed—an average of 40 cookers per month—at Townsville, Queensland.

In regard to our undertakings in Queensland—namely, Rockhampton, Wynnum, Ipswich, and Sandgate, I have recently returned from an inspection of these properties, and am impressed with the large field for expansion that exists, especially in the first three towns named.

Respecting our undertakings in New South Wales, the gasholders, which are very important pieces of the works plant, at Grafton, Singleton, and Wollongong have been renewed, and as a result of this work economy in expenditure on coal and wages will accrue. New showrooms have been opened in some districts, and in other instances existing showrooms improved and staff changes have taken place.

Similar work to that performed in Queensland is being carried out, with the result that substantial increases in the consumption of gas are being experienced at our New South Wales undertakings. As a general reflex of our efforts to increase the consumption of gas, the increase in sales of gas from subsidiary gas undertakings was 6·1 p.ct.

Two amalgamations have taken place since we last met—the larger one being with the Rockhampton Gas and Coke Company, whose Directors, in October, 1928, received offers for amalgamation with a view to recommending the most satisfactory offer to the members. The second amalgamation was with the Wynnum and Manly Gas and Lighting Company, Ltd.

Mr. J. S. WEIR seconded the motion for the adoption of the report and balance-sheet, and Mr. JAMES MACDOUGALL also supported the motion.

DECLARATION OF DIVIDEND.

The CHAIRMAN then moved: (*a*) That a dividend at the rate of 8 p.ct. per annum (*less* interim dividend of 4 p.ct. for the half-year ended Dec. 31, 1928) be paid on the preference shares; (*b*) that a dividend at the rate of 9 p.ct. per annum (*less* interim dividend of 4½ p.ct. for the half-year ended Dec. 31, 1928) be paid on the ordinary shares; (*c*) that £1000 be added to the reserve fund; (*d*) that £9500 be set aside for Australian income-taxes on profits earned to June 30, 1929; and (*e*) that the balance (approximately £14,116) be carried forward to the next account.

Sir ARTHUR ROBINSON seconded this resolution, which was carried unanimously.

Mr. J. M. MACFARLANE moved a vote of thanks to the Chairman and his co-Directors for their excellent work, also to the Managers and staffs at the various works of the Association and its subsidiary undertakings, the Secretary and officers generally.

Mr. JAMES HURLL seconded the motion, which was carried with acclamation.

The CHAIRMAN briefly responded.

THE UNIVERSITY OF LEEDS.

Department of Coal Gas and Fuel Industries with Metallurgy. Programme of Special Courses for Session 1929-30.

In connection with the work of the Department, arrangements have been made for the delivery, during the second term of the session, of the following special courses of evening lectures:

I.—The Manufacture of Coal Gas.

MR. RHEAD AND MR. HOLLINGS.

A course of twelve lectures divided into two sections, A and B, will be given on Fridays during the second term.

A. Carbonization Practice.

This section will be given by Mr. T. F. E. Rhead, M.Sc., A.I.C., Chief Chemist, City of Birmingham Gas Department. It will consist of six lectures given at 6 p.m. and 7.30 p.m. on Fridays, commencing Jan. 24 and concluding Feb. 7, 1930.

SYLLABUS.

Gas-making coals and their behaviour when carbonized. Construction (including ironwork) of horizontal and inclined retorts, intermittent and continuous vertical retorts, chamber and coke ovens, water gas and complete gasification plants. Refractories and their effect on design. Heating of retorts, external and internal producers. Recovery of waste heat. Comparison of nature and yields of solid, liquid, and gaseous products from the various types of gas-making plants. Thermal and economic efficiencies. Factors affecting design of plant, processes, and composition of crude gas. Mechanical handling of coal and coke. Testing coals in the laboratory and on the large scale. High and low temperature carbonization in relation to production of solid smokeless fuel. The 1920 Gas Regulation Act and recent progress in carbonizing methods.

B. Gas Purification Practice.

This section will be given by Mr. H. Hollings, M.Sc., A.I.C., Chief Gas Chemist, Gas Light and Coke Company, London. It will consist of six lectures given at 6 p.m. and 7.30 p.m. on Tuesdays, commencing Feb. 18 and concluding March 4, 1930.

SYLLABUS.

Nature of the impurities in crude coal gas and the factors affecting their formation. General outline of purification processes. The principles of cooling and condensation. The function, design, and operation of air and water cooled condensers, tar fog extractors, &c. The electrical precipitation of tar. The principles of ammonia extraction. The constitution of ammoniacal liquor, with particular reference to still effluents. The design and operation of washers and scrubbers. The semi-direct recovery of ammonia. The simultaneous removal of ammonia and hydrogen sulphide. The removal of cyanogen. The removal of hydrogen sulphide with special reference to processes making use of oxide of iron. The design and operation of oxide of iron purifiers. The selection and purification of oxides of iron. The removal of carbon bisulphide and naphthalene. The recovery of benzole. The contamination of gas on storage.

Fee for this Course: Sections A and B, £1; for either Section taken separately, 12s. 6d. each.

II.—Refractory Materials.

PROF. COBB AND DR. SUGDEN.

A. A course of eight lectures will be given by Prof. J. W. Cobb, C.B.E., B.Sc., F.I.C., of Leeds University, on Tuesdays at 6 p.m. and 7.30 p.m., commencing Jan. 14 and concluding Feb. 4, 1930.

SYLLABUS.

Physical and chemical principles on which the manufacture and use of refractory materials are based. Consideration of raw materials available and manufacturing processes. Choice of refractory materials for use in furnaces of different types. Methods of testing.

Physical Properties of Refractory Materials.

B. A course of two lectures will be given by Mr. J. A. Sugden, Ph.D., Research Assistant and Assistant Lecturer on Refractory

Materials in the University of Leeds, at 6 p.m. and 7.30 p.m. on Tuesday, Feb. 11, 1930.

SYLLABUS.

The lectures will deal in more detail with the physical properties of silica, fireclay, magnesia, and other refractory materials.

Fee for the Course: Sections A and B, 17s. 6d.; for the Sections taken separately, A, 15s., B, 5s.

III.—Metallurgy.

MR. SUMMERS.

A course of six lectures on the microscopic study of engineering alloys, followed by practical work in the laboratory, will be given by Mr. P. F. Summers, A.R.S.M., on Fridays, at 6 p.m., commencing Feb. 7 and concluding March 14, 1930. The course will be divided into two parts, which may be taken separately, though all intending students are expected to enrol on Feb. 7.

PART 1.—General (3 lectures with laboratory work):
An introduction to the metallographic study of metals and alloys, their preparation and examination. The composition and uses of various engineering alloys.

PART 2.—Special (3 lectures with laboratory work):
Metals and alloys resistant to corrosion and oxidation.

Fee for each part (including laboratory work), 7s. 6d.

IV.—Evening Laboratory Course.

PROF. COBB, MR. HODSMAN, AND MR. SUMMERS.

The laboratory of the Department will be open on Friday evenings between 6 p.m. and 9 p.m. from Feb. 7 to March 14, 1930, for a limited number of students who have already received some chemical training, but who desire instruction in fuel calorimetry and pyrometry. More advanced students, capable of independent work, may also be admitted to the laboratory during these periods.

The earliest possible application from intending students is requested.

Fee, 15s.

V.—Day Lecture Courses.

For information respecting the day lecture courses in the Coal Gas and Fuel Industries Department of the University—namely in:
Properties of Gases;
Technology of Fuel;
General and Non-ferrous Metallurgy;
Iron and Steel;
Alloys and Metallography—
see the special prospectus of the Department, obtainable on application to the Registrar.

VI.—Admission of Students, Inquiries, &c.

Intending students are requested to send in their names without delay to the Registrar of the University, specifying at the same time what course or courses they wish to attend. Other inquiries regarding the course should be addressed to Prof. Cobb, the Head of the Department of Coal Gas and Fuel Industries (with Metallurgy).

The University reserves the right to decide that any course shall not be given if the number of entries is inadequate.

In view of the demands on the University accommodation, the earliest possible application for admission to the day courses commencing October, 1930, is advisable.

The fees for the respective courses are payable in advance on the date of the first lecture.

GAS INDUSTRY QUARTERLY REVIEW.

A Striking Tribute.

The Gas Industry Quarterly Review, which is now becoming a regular feature of the "Manchester Guardian," appeared in the edition of Dec. 17, and it bore evidence of the great strides being made by the industry in various directions.

The review, at the outset, draws attention to the important work being done and remaining to be done in connection with bye-products recovered during carbonization. Taking for example that important product, tar, figures were given to indicate the extent of its use in Great Britain and its superiority—both technically and financially—over rival products for road dressing. The British Road Tar Association, it was stated, had laid an experimental section of tarmacadam on a main road leading out of London. Special refined tar was used, and also a carefully graded aggregate, and though for two years this had been subjected to daily traffic of 25,000 tons, it remained in the same good condition as when it was put down.

British roads, of course, are still a long way from having reached their ultimate state of development, but, in addition to this home outlet for tar, there are opportunities for its sale abroad. Nothing should be left undone, it was urged, in the exploration of these and, in fact, every possible outlet for this important bye-product.

BENZOLE AND CREOSOTE RECOVERY.

Satisfaction was shown in the interest at last being aroused in the recovery of benzole from coal gas, and reference was made to the valuable work of Mr. H. Hollings, Dr. S. Pexton, and Dr. R. Chaplin, recently described at a conference of the Institute of Chemical Engineers, on the recovery of benzole from coal gas with particular reference to the use of active charcoal [see "JOURNAL" for Dec. 11, p. 715]. Several points of interest in the paper were commented upon, particularly that the process needed the most careful consideration from the point of view of expense.

Another interesting situation reviewed was that of creosote, and it was emphasized that, on account of the falling market, unless something is done, and done quickly, in the matter, it will automatically reflect unfavourably in the revenue returns from the tar products. The problem is receiving attention, however, and interesting suggestions recently put forward include the possibility of dividing the creosote into two fractions—one for use in gas-works and one for power purposes in an internal combustion engine of the Diesel type. It has also been suggested that the creosote could be used as fuel, an example of its application in this way for burning under boilers having shown that three tons of creosote are equal to five tons of coal.

SMOKE ABATEMENT.

Finally, the question of smoke abatement received attention. In recent weeks Manchester has been subjected to an intensive campaign in this direction, and it is gratifying to note that the campaign has borne fruit. The various departments concerned, we understand, have been inundated with orders for smokeless fuel, and in one case it is rumoured that orders are two hundred behind.

Stress was laid upon Mr. Clayton's suggestions at the recent meeting of the Manchester and District Institution of Gas Engineers, that common funds might be used to a greater extent to bring about the purification of the atmosphere. Such schemes were based on the formation of independent area organizations, supported on an independent financial basis up to 1d. a year per head of population.

It is certainly the most opportune time of year for a review such as this. As already stated, the demand for gas-works coke in Manchester at the moment exceeds the supply, and if by some such scheme as that outlined by Mr. Clayton the sales of gas could also be considerably increased, the all-round advantages would be very appreciable indeed. In the meantime, however, this brief survey should be sufficient to show that the industry is doing everything possible to reduce the price of gas by attending to each item in the costs of production.

The review was backed up by comprehensive publicity matter by leading gas concerns, including, besides the Manchester Gas Department's own advertisement and one by the Stretford and District Gas Board, one of the well known and attractive Radiation posters setting forth the advantages of the new "Beam" radiants; one by the British Commercial Gas Association on gas for industrial purposes; and another by West's Gas Improvement Company, Ltd., on the subject of carbonizing advantages claimed for continuous vertical retorts.

The review should be of particular interest to the general public in showing how their gas undertakings are leaving no stone unturned in their efforts to produce cheap gas and bye-products, and the information contained therein is a striking tribute to the efficiency of the industry and a credit to its producers.

BRITISH BENZOL AND COAL DISTILLATION.

First Annual General Meeting.

The First Annual General Meeting of British Benzol and Coal Distillation, Ltd., was held on Dec. 18 at Winchester House, E.C.

Major-General Sir NEILL MALCOLM, K.C.B., D.S.O. (the Chairman), said that when they met last year he told the shareholders that their plant would be completed and in working order by the end of this year. That promise had been fulfilled. The heating up of the ovens was started on Oct. 4, the first contract, which was for their benzole, was signed by their sales agents on Nov. 8, and their first coke was produced on Dec. 6. At the present time they were coking 340 tons of raw coal a day in place of the 750 tons of which the plant was capable. The output would be increased gradually in accordance with sound technical practice, and maximum quantities should be reached before the end of next month.

In regard to sales, the whole of their benzole and solvent naphtha had been sold for 12 months ending Nov. 30, 1930, at prices substantially better than those given in the prospectus. On the other hand, the price of creosote had fallen, but the balance should be in their favour. The value of their coke, which depended upon analysis and ash content, could not be finally determined until the auxiliary plant was in full operation.

THE BECKER OVENS.

Sir ARTHUR DUCKHAM, G.B.E., K.C.B., M.Inst.C.E., said the plant erected at Bedwas was of the high-temperature coke oven type. The design of oven was known as the Becker, and had been taken up by them because they considered it the simplest and strongest in existence. The Becker oven was of American origin, and since 1922 88½ p.ct. of all coke ovens built in America had been of that type. The total of Becker ovens built was 4440, and these had a carbonizing capacity of 34 million tons of coal a year. Two plants, other than Bedwas, had been erected in this country at Nunnery and Thorncliffe, in the Sheffield area.

The Bedwas plant had been completed in the time scheduled, and had gone to work in a normal manner, despite the almost unprecedented weather conditions prevailing during the period. Certain minor mechanical faults were being adjusted. The work was following a normal course, and the plant should be up to full output by the end of January.

The report was unanimously adopted.

CONSUMERS' GAS COMPANY OF TORONTO.

Eighty-First Annual Meeting.

The Eighty-First Annual General Meeting of the Consumers' Gas Company of Toronto was held at the Company's Auditorium, 55, Adelaide Street East, on Monday, Nov. 18, 1929, at noon.

The PRESIDENT (Mr. A. W. Austin) was called to the Chair, and presented the annual report and financial statement, which showed that the progress of recent years has been fully maintained, and they were again able to report a substantial increase in the volume of gas sold during the year as compared with the preceding year. The total number of gas meters in service at the end of the year was 165,477, an increase of 5130 during the year. Though the increased demands made upon the Company's facilities during the year were fully and satisfactorily met, the Directors have deemed it necessary to extend the coal gas plant at Station "A" by the addition of four settings of Glover-West vertical retorts capable of producing a million c.ft. of gas per day, together with waste-heat boilers and the necessary primary gas condensers. The sale of gas appliances by the Commercial Department shows a very satisfactory increase in volume. Continued efforts were made during the year to stimulate the sale of gas for industrial purposes, resulting in an increase in the quantity of gas used in manufacturing establishments during the year of 7 p.ct. as compared with last year, and an increase of 62 p.ct. as compared with five years ago.

The following statement for the past year, as compared with the preceding one, shows—

	Meters.	Gas Sales.
Year ended Sept. 30, 1929 . . .	165,477 ..	$5,869,928.01
Year ended Sept. 30, 1928 . . .	160,347 ..	5,642,557.99
Increase	5,130 ..	$ 227,370.02

In moving the adoption of the report, the PRESIDENT said: It can be stated that there never has been a time in the Company's history when its financial position was in a sounder and healthier condition. It is always pleasing to report the expansion of the Company's own business, but it is also very reassuring to note the steady increase from year to year in the sale of gas and in the number of customers served, reported for the industry as a whole, both in Great Britain and the United States.

The VICE-PRESIDENT, Dr. F. LeM. Grasett, seconded the resolution.

The GENERAL MANAGER, Mr. A. Hewitt, being called upon, described the method of gas distribution employed by the Company. He stated that there had been laid some 919 miles of street mains and 1352 miles of service pipes, the two forming a network of 2271 miles of pipes, through which gas was distributed at a uniform pressure throughout the entire system. The extent of the area covered by this network of pipes was 18 miles east and west by 9 miles to the north. In giving an outline of the organization of the Company, he stated that the maximum number of employees engaged in the operations of the Company during the year was 1700, the average number constantly employed 1300, and the total amount paid as wages during the year over $2,000,000.

The resolution for the adoption of the report was carried unanimously.

IMPERIAL COLLEGE OF SCIENCE AND TECHNOLOGY.

Annual Dinner.

The Annual Dinner of the Imperial College of Science and Technology was held on Monday, Dec. 9, at the Hotel Victoria. In the absence of the Lord Buckmaster through indisposition, the Rector of the College, Mr. H. T. Tizard, presided.

Lord PARMOOR, in proposing "The College," said that nothing could be more important than to attempt to meet the industrial difficulties in this country by scientific and technological discoveries and research. He did not wish to run down sport and amusement, but he thought they ought to be kept in a secondary place. He looked with some suspicion at the extraordinary growth of sport in his old University—Oxford. At the Imperial College sport was subordinated to the greater necessity of learning.

The CHAIRMAN, responding, said that scientific men as a whole did not display a great interest in politics. They were led to regard the facts of the day as they were, and not to bind themselves readily to doctrine.

Prof. W. W. WATTS, in proposing the toast of "The Guests," drew attention to the fact that the College was living through a difficult period; the new Statutes of London University presenting problems which they were loyally trying to solve.

Lord PASSFIELD, replying, congratulated the College on its progress.

Longtown Gas-Works Theft.—The story of an audacious theft of lead piping and brass couplings from Longtown (Cumberland) Gas-Works was narrated to the Longtown Magistrates at a special court on Dec. 13. The defendant was Alexander Anderson (34), of Kirkpatrick Fleming, Dumfriesshire, who pleaded guilty. Superintendent Stewart, prosecuting on behalf of the police, said that during Wednesday night defendant entered the gas-works and cut and tore from meters in the meter house a quantity of piping and disconnected brass couplings. Defendant took the stolen material away in a bag. By defendant's action the Gas Company had lost nearly 3000 c.ft. of gas, and, had a light been used in the meter house, there would have been an explosion, and serious damage and injury would have resulted. In view of the fact that life might have been imperilled the Magistrates passed sentence of two months.

SECOND WORLD POWER CONFERENCE, BERLIN, 1930.

The recently published form of application for participation in the Second World Power Conference, which is to be held in Berlin in 1930, gives a summary of the numerous scientific and social arrangements which have been planned in connection with this great international congress, at which the power specialists from all parts of the world will meet in the German capital next June. In addition to the scientific discussions on the different technical subjects, there will be a reception in the Reichstag, an opening ceremony in the auditorium of the Kroll Opera House, a great World Power Festival, and a number of informal meetings of the participants.

Accompanying the application form is a guide book to the German industrial works, which explains the comprehensive programme of visits which has been drawn up by the Executive Committee of the World Power Conference in order to give the many visitors expected from abroad an opportunity not only to study German industrial methods, but also to get to know, and to appreciate, the natural beauties and the special characteristics of different parts of Germany.

At present the list of works to be visited numbers about two hundred. About half of these are power stations and gas-works, and the other half are energy-consuming enterprises, such as coal mines and steel works, chemical works, factories which manufacture electrical machines, steam turbines, and internal-combustion engines, shipbuilding yards, wireless stations, and so on. The seven different itineraries, which radiate in all directions from Berlin, take in the immediate environs of the capital, the industrial centres of the Rhineland and Westfalia, Baden, Bavaria, Upper Silesia, Pomerania, and East Prussia, and the Hanseatic Towns of Bremen, Hamburg, and Lübeck.

Since the conference is already arousing great interest all over the world, it is advisable to take the earliest possible opportunity of sending in the applications for participation in the conference and the visits, as only a limited number of persons can take part in any one of the arrangements planned. Forms of application, giving all the information necessary, can be obtained from the Executive Committee of the Second World Power Conference, Berlin, NW. 7, Ingenieurhaus.

OVERSEAS OPPORTUNITIES.

[From the Board of Trade Journal.]

Australia.

Refractory Bricks and Fireclay for Boiler Furnaces, required for the Yallourn Power Station. (Specification No. 30/7.)—H.M. Trade Commissioner at Melbourne reports that the State Electricity Commission of Victoria is calling for tenders, to be presented in Melbourne by Feb. 17, 1930, for the supply of the above. Firms desirous of offering refractory bricks and fireclay of British manufacturers can obtain further particulars of this call for tenders upon application to the Department of Overseas Trade, 35, Old Queen Street, London, S.W. 1. (Ref. B.X. 5960.)

South Africa.

Pig Iron and Ferro Manganese.—H.M. Senior Trade Commissioner in South Africa reports that the South African Railways and Harbours are calling for tenders, to be presented in Johannesburg by Jan. 30, 1930, for the supply of pig iron and ferro manganese during the period May 1 to Dec. 31, 1930. (Tender No. 1592.) Firms desirous of offering materials of British manufacture can obtain further particulars of this call for tenders upon application to the Department of Overseas Trade, 35, Old Queen Street, London, S.W. 1. (Ref. A.X. 8915.)

DIARIES, CALENDARS, &c.

Seasonable gifts in the form of diaries, calendars, &c., have been received from the following firms:—

Association of Architects, Surveyors, and Technical Assistants, 26, Buckingham Gate, S.W. 1.
Beaumont, W. G., & Son, Priory Works, Bow, E. 3.
Gas Meter Company, Ltd., 238, Kingsland Road, E. 2.
Jeavons, E. E., & Co., Ltd., Tipton.
Luton Gas Company
Standard Furnace and Setting Company, 150, Lord Street, Southport.
Staveley Coal and Iron Company, Ltd., near Chesterfield.
Wailes Dove Bitumastic, Ltd., Collingwood Buildings, Newcastle-on-Tyne.

Pontardulais Gas Company.

In the Chancery Division on Thursday last, Mr. Roxburgh moved, on behalf of the debenture holders in the Pontardulais (Glamorgan) Gas Company, for the appointment of a Receiver of the Company's assets. He said he apprehended that his Lordship would assent to the appointment of a Receiver, but not a manager, and his clients would be satisfied with that. The Receiver would be the Secretary of the Company.

Mr. Brough (for the Company) said his clients raised no objection, and his Lordship made the order as requested.

CURRENT SALES OF GAS PRODUCTS.

The London Market for Tar, Tar Products, and Sulphate.

LONDON, *Dec.* 20.

There is little change to record in the prices of products since last reported, except that pure toluole is firm at 2s. 5d. to 2s. 6d.

Tar Products in the Provinces.

Dec. 20.

The average prices of gas-works products during the week were: Gas-works tar, 25s. to 30s. Pitch—East Coast, 47s. 6d. f.o.b. West Coast—(f.a.s.) Manchester, 42s. to 42s. 6d.; Liverpool, 45s. 6d. to 46s. 6d.; Clyde, 45s. 6d. to 46s. 6d. Toluole, naked, North, 1s. 7½d. to 1s. 8½d. Coal-tar crude naphtha, in bulk, North, 9d. to 10d. Solvent naphtha, naked, North, 1s. 3d. to 1s. 3½d. Heavy naphtha, North, 1s. to 1s. 0½d. Creosote, in bulk, North, liquid and salty, 3¼d. to 3⅜d.; low gravity, 2d. to 2¼d.; Scotland, 3¼d. to 3⅜d. Heavy oils, in bulk, North, 5½d. to 6d. Carbolic acid, 60's, 2s. 4d. to 2s. 6d. prompt. Naphthalene, £12 to £14. Salts, £5 to £5 10s., bags included. Anthracene, "A" quality, 2½d. per minimum 40 p.ct., purely nominal; "B" quality, unsaleable.

Tar Products in Scotland.

GLASGOW, *Dec.* 19.

Trade is practically at a standstill, the holidays being predominant in the minds of distillers and traders alike. Creosote oil continues weak, and pitch and cresylic are steady with market short of prompt supplies.

Pitch is very steady in this area, and makers would not sell for export at prices ruling elsewhere. The nominal value is 47s. 6d. to 50s. per ton f.a.s. Glasgow. Home trade orders command about 5s. per ton extra.

Tar is a firm market, further orders having been placed at about 3¼d. to 4⅜d. per gallon f.o.r. makers' works.

Creosote is unaltered, and prices are easy. B.E.S.A. specification is 3¼d. to 4⅜d. per gallon; light oils, 3¼d. to 3⅜d. per gallon; neutral oil, 3d. to 3½d. per gallon, all free on rails at makers' works.

Cresylic.—The demand is not so great. Values, however, are unaltered at 1s. 9½d. to 1s. 10½d. per gallon for 97/99 p.ct. pale, 1s. 8½d. to 1s. 9½d. per gallon for 97/99 p.ct. dark, 2s. 1d. to 2s. 2d. per gallon for 99/100 p.ct. pale, and 1s. 11d. to 2s. per gallon for high boiling.

Crude naphtha quotations are still in the neighbourhood of 5⅝d. to 6½d. per gallon *ex* works naked.

Solvent naphtha stocks are increasing; but no alteration has been made in quoted prices, which remain at 1s. 1½d. to 1s. 2d. per gallon for 90/160 grade and 1s. to 1s. 0½d. per gallon for 90/190 grade.

Motor benzole is unchanged at 1s. 5d. to 1s. 5½d. per gallon in bulk quantities.

Pyridine nominal value continues at about 3s. 3d. to 3s. 6d. per gallon for 90/160 quality.

Benzole Prices.

The following are considered to be the market prices to-day:

	s. d.	s. d.	
Crude benzole . . .	0 10	to 0 11	per gallon at works
Motor ,, . . .	1 5	,, 1 6	,, ,, ,,
90 p.ct. ,, . . .	1 7	,, 1 8	,, ,, ,,
Pure ,, . . .	1 10	,, 1 11	,, ,, ,,

SULPHATE OF AMMONIA PRICES.

Season 1929-30.

Nitram, Ltd., in the course of a circular recently issued, say:

We give you below the prices at which we are prepared until further notice to book orders for sulphate of ammonia for home agricultural use during the present season. In fixing these prices, the 1s. per ton rebate on railway carriage which was allowed during a part of last season, to give buyers the benefit of the De-Rating Act, has been taken into account, so that in future no rebate or allowance of this nature will be made. We reserve the right to raise our prices at any time by sending out a printed notice to that effect. Any such increase in price will apply to all orders received after the date of issue of the notice. There will be no allowance for taking delivery *ex* works. As practically no ordinary quality is likely to be available, we refrain from quoting a price for this quality. It is understood that quantities purchased at the price stated below will be used for home agricultural purposes only. We offer to sell sulphate of ammonia for home agricultural use at the following prices for delivery in January, £10, and February-June, £10 2s. per ton for neutral quality guaranteed to contain 20·60 p.ct. of nitrogen by weight, and not to contain more than 0·025 p.ct. of free acid (H_2SO_4), and to be in readily friable condition at the time of delivery, delivered to consumer's nearest station or wharf in Great Britain (or c.i.f. main ports for the Isle of Man) for prompt cash payment in lots of 6 tons and upwards, packed in single bags containing about 2 cwt. net to be supplied free by sellers, tare allowed. When credit is given, a reasonable extra charge may be made, but the discount allowed for prompt payment should be quoted on the invoice. The above prices will also apply to deliveries of 1 ton and upwards *ex* works or *ex* store to buyers' road vehicle.

A statement of conditions follows.

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Gas Calorimeters, : : :

Pressure and Vacuum Indicators and Recorders,

Roland Wild Calorimeters,

CO_2 Recorders, : : :

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Gas Analysis Apparatus, :

Laboratory Gas Meters, :

Thermometers, : : :

Water Meters, : : :

Photometers, : : etc.

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'Grams: "Precision, Sowest, London."

COAL TRADE REPORTS.

From Our Own Correspondents.

NORTH-EAST COAST.

As is usual, after a lean period due to bad weather, there has been a surplus of tonnage at the shipping places, and collieries are being hard pressed for deliveries to complete shipments before the Christmas and New Year holidays. All classes of coal are in brisk demand, and prices are well maintained for delivery for several weeks ahead.

Good gas coals are well booked; Wear special qualities being firm at 17s. 6d. f.o.b., and bests at 17s. Seconds are good at 15s. 3d. to 15s. 9d. Durham coking are harder at 15s. 9d. to 16s. 3d. according to quality. Bunker sorts are in good request, especially for coaling station cargoes, and best qualities are scarce at 16s. to 16s. 9d. Seconds are in improved demand at 15s. 3d. to 15s. 6d. In Northumberlands, the D.C.B. market is particularly firm, and 17s. 6d. f.o.b. is asked for the whole of January.

Supplies of gas coke are very scarce, and 26s. f.o.b. is nominally indicated for shipment.

MIDLANDS.

Very little further progress has been made with negotiations for gas coal contracts over the twelve months from Midsummer next. Some of the gas-works managements are on the alert, however, for any opportunities which promise them a measure of security against the instability in the industry which is threatened by legislative patchwork.

The seasonal stimulus in the house coal trade has been relatively inconsiderable. There was some increase of activity in the distributive channels just before Christmas; but at pits producing a large proportion of domestic grades three and a half to four days' work a week was sufficient to supply requirements.

In the industrial market, the year closed flat. There was no disposition to buy ahead save in exceptional cases, and no pressure for supplies in preparation for resumption of work after the holidays.

The only direction in which there is stringency is in the coke market. Both gas and furnace coke have been called for almost faster than they could be supplied, and high prices have not checked the demand. Ovenmen have equipped themselves so largely for earning the larger profits which the non-industrial trade returns that blast-furnaces have suffered. Good average smelting coke cannot be bought on the open market at less than 18s. to 18s. 6d. at the ovens.

The Blackburn Gas Committee have approved an estimate of £19,600 for the laying of gas mains and services under an unemployment scheme.

CONTRACTS OPEN.

Coal.

The Wallasey Corporation invite tenders for the supply of gas coal. [See advert. on p. 854.]

Colonial Gas Association.—Circulars were recently sent to the shareholders and debenture holders in the Colonial Gas Association, Ltd., offering 1200 6½ p.ct. debentures of £100 each. The list of applications closed on Dec. 16, and the issue was heavily oversubscribed.

Bishop Auckland Gas Fire Fatality.—Mrs. May Lewis, aged 27, of Cedar Road, Bishop Auckland, has died in the Auckland Cottage Hospital from burns which she received in her home. She was attempting to light a gas stove when it back-fired, and her clothing caught alight.

New Water Gas Plant for Bradford.—The Bradford Corporation Gas Committee have decided to instal a water gas plant at the Valley Road Works, to augment the supply of gas in case of emergency, at a cost of about £18,000. The plant is estimated to produce 2 million c.ft. a day.

Explosion in the West-End.—On the afternoon of Dec. 18 there was an explosion in a manhole in Bond Street, W.; the cover being blown out. The electric lighting in the shops extending for a distance of a quarter of a mile on one side of Old Bond Street and New Bond Street was extinguished at a very busy time, and much inconvenience was caused.

New Vertical Retort Installation at Otley.—Sir Arthur Duckham, at a luncheon given by the Otley Gas Company, on Dec. 10, to celebrate the inauguration of a continuous vertical retort installation at the local gas-works, at a cost of £20,000, said he could see a happy and prosperous future for gas. Sir Arthur said the gas industry was making headway and holding its own in spite of opposition, and the end of its development had not yet been seen. Mr. F. T. Hunter, Chairman of the Otley Gas Company, who presided at the luncheon, said that in 1892 the Company sold about 25 million c.ft. of gas; whereas last year the output was 98 million c.ft.

The Bromley Works of the South Suburban Gas Company had little difficulty in surviving the third round of the London Intermediate Cup on Dec. 7. Playing very sound football, the works defeated Walthamstow Avenue Reserves by 4 goals to *nil*.

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STOCK AND SHARE LIST.

[For Stock Market Report, see earlier pages.]

Issue.	Share.	When ex-Dividend.	Dividends, Prev. Hf.Yr	Dividends, Last Hf. Yr.	NAME.	Quotations, Dec. 18.	Rise or Fall on Week.	Transactions Lowest and Highest Prices.
£			%p.a.	% p.a.				
171,978	Stk.	Aug. 15	5	5	Aldershot 5 p.c. max. C. .	70—75	..	..
412,992	,,	,,	4	4	Do. 4 p.c. Pref. . .	71—74	..	..
1,851,868	,,	Sept. 26	7½	7½	Alliance & Dublin Ord. .	95—98	..	93½—95½
374,000	,,	July 11	4	4	Do. 4 p.c. Deb. . .	62—65	..	..
623,655	,,	Aug. 29	7	7	Barnet Ord. 7 p.c. . . .	112—115	..	..
800,000	1	Oct. 24	1/4½	1/4½	Bombay, Ltd.	16/—18/-	..	..
172,500	10	Aug. 29	8½	9	Bournemouth 5 p.c. . .	12½—13½	..	..
800,050	10	,,	7	7	Do. B 7 p.c. . .	12⅜—12½	..	12⅜
499,160	10	,,	6	6	Do. Pref. 6 p.c. .	10½—11	..	10½
60,000	Stk.	July 11	3	3	Do. 3 p.c. Deb. .	54—57	..	..
163,925	,,	,,	4	4	Do. 4 p.c. Deb. .	72—75	..	..
367,900	,,	Aug. 29	7½	7½	Brighton & Hove 6 p.c. Con.	113—116	..	..
271,880	,,	,,	6½	6½	Do. 5 p.c. Con.	100—103	..	..
1,367,500	,,	July 25	5	5	Bristol 5 p.c. max. . . .	87—89a	..	..
885,000	,,	Sept. 12	7½	7	British Ord.	114—117	..	114
100,000	,,	June 27	7	7	Do. 7 p.c. Pref. . . .	112—117	..	..
120,000	,,	,,	4	4	Do. 4 p.c. Red. Deb. .	71—74	..	70—72½
450,000	,,	,,	5	5	Do. 5 p.c. Red. Deb. .	94—97	..	..
100,000	10	Dec. 5	8	6	Cape Town, Ltd. . . .	8½—9½*	..	..
100,000	10	Nov. 7	4½	4½	Do. 4½ p.c. Pref. . .	6¾—7½	..	..
150,000	Stk.	June 27	4½	4½	Do. 4½ p.c. Deb. . .	71—76	..	..
696,860	,,	July 25	6	6	Cardiff Con. Ord. . . .	98—101	..	..
167,880	,,	June 27	7½	7½	Do. 7½ p.c. Red. Deb. .	99—102	..	..
187,150	,,	Aug. 15	6½	5	Chester 5 p.c. Ord. . . .	87—92b	..	..
98,936	1	Oct 10	1½/-	1½/-	Colombo Ltd. Ord. . . .	84/—86/-	..	..
24,495	1	,,	1/4½	1/4½	Do. 7 p.c. Pref. . .	19/—21/-	..	..
875,402	1	Oct. 10	1/9½	1/9½	Colonial Gas Assn. Ld. Ord.	23/6—25/6	..	..
187,848	1	,,	1/7½	1/7½	Do. 8 p.c. Pref.	20/—22/-	..	..
1,078,980	Stk.	July 25	7	5	Commercial Ord.	90—95	..	91—92½
475,000	,,	June 18	3	3	Do 3 p.c. Deb. .	55—58	..	..
787,660	,,	Aug. 15	7	7	Croydon sliding scale . .	105—108	..	..
400,100	,,	,,	5	5	Do. max. div. . . .	80—85	..	..
542,270	,,	Aug. 29	10	7	Derby Con.	118—121e	..	..
55,000	,,	June 27	4	4	Do. Deb.	68—71e	..	..
300,000	,,	Aug. 29	5	5	East Hull Ord. 5 p.c. . .	73—76	..	..
1,909,180	10	Sept. 12	17	14	European, Ltd.	12½—14½	..	12/18/—13⅞
19,708,480	Stk.	July 25	5⅝	5⅝	Gas Light & Coke 4 p.c. Ord.	17/9—18/3f	..	17/10½—18/3
2,690,000	,,	,,	8½	8½	Do. 8½ p.c. max. . . .	60—62	..	61½
4,187,020	,,	,,	4	4	Do. 4 p.c. Con. Pref. .	73—76	..	75¾
3,805,620	,,	June 18	3	3	Do. 3 p.c. Con. Deb. .	57—59	..	56/16/—59
2,643,770	,,	,,	5	5	Do. 5 p.c. Red. Deb. .	98—100	..	96½—99½
88,500	,,	Aug. 29	7	7	Hastings & St L. 5 p.c. Conv	98—103	..	..
388,740	,,	,,	5½	5½	Do. 5½ p.c. Conv.	77—82	..	..
10,000	10	Oct. 10	†10	†10	Hongkong & China, Ltd. .	13½—14½	..	..
318,800	Stk.	Aug. 29	6	6½	Hornsey Con. 6½ p.c. . .	84—87	..	..
1,976,000	,,	Nov. 21	20	18	Imperial Continental Cap.	335—355	..	332—338
232,186	,,	Aug. 15	8½	8½	Do. 8½ p.c. Red. Deb.	71—76	..	72
226,343	,,	Aug. 15	7½	8	Lea Bridge 8 p.c. Ord. . .	115—118	..	..
2,146,807	,,	Aug. 15	6½	6	Liverpool 5 p.c. Ord. . .	91—92b	..	..
600,000	,,	Sept. 26	7	7	Do. 7 p.c. Red. Pref.	100½—102½b	..	..
168,736	,,	Aug. 29	8	9	Maidstone 5 p.c. Cap. . .	122—127	..	..
63,480	,,	June 27	3	3	Do. 3 p.c. Deb. . .	53—56	..	..
75,000	8	Dec. 5	†10	†10	Malta & Mediterranean	5¼—6*	..	..
393,000	—	Oct. 1	5½	5¼	Metrop't'n (of Melbourne) 5½ p.c. Red. Deb. . . .	92—95	..	..
841,920	Stk.	Nov. 21	†9	†6	Montevideo, Ltd. . . .	103—106	..	..
1,051,818	,,	July 25	5⅝	5	Newcastle & Gateshead Con.	15/9—16/6d/	..	..
682,856	,,	,,	4	4	Do. 4 p.c. Pref. .	71½—72½d	..	..
891,705	,,	June 27	8½	8½	Do. 8½ p.c. Deb. .	66½—67½d	..	..
181,780	,,	Aug. 29	7/1/0	7½	North Middlesex 6 p.c. Con.	112—117	..	..
396,160	,,	Aug. 15	5	5	Northampton 5 p.c. max .	76—79	..	..
800,000	,,	Nov. 21	7	9	Oriental, Ltd.	108—113	..	..
205,162	,,	June 27	8	8	Plym'th & Ston'house 5 p.c.	110—115	..	..
424,416	,,	Aug. 29	8½	8	Portsm'th Con. Stk. 4p.c. Std.	113—118	..	..
341,446	,,	,,	5	5	Do. 5 p.c. max.	80—83	..	..
2,384,464	1	June 27	—	‡5	Primitiva Ord.	28/—31/-	..	28/9
244,500	100	Dec. 2	4	4	Do. 4 p.c. Red. Deb. . .	91—94*	..	..
695,000	Stk.	July 25	4	4	Do. 4 p.c. Red. Deb. 1911	79—82	..	..
416,345	,,	June 27	4	4	Do. 4 p.c. Cons. Deb. . .	79—82	..	..
150,000	10	Sept. 26	6	6	San Paulo 6 p.c. Pref. . .	8½—9	..	..
1,736,968	Stk.	Aug. 29	6½	6½	Sheffield Cons.	104—106e	..	..
95,000	,,	July 11	4	4	Do. 4 p.c. Deb. . . .	75—77e	..	..
90,000	10	June 18	‡4	‡4	South African	4—6	..	98/14—5
6,809,895	Stk.	July 26	7½	5	South Met. Ord.	99—101	..	99½—100½
500,000	,,	,,	6	6	Do. 6 p.c. Irred. Pf.	106—109	..	..
1,895,445	,,	July 11	3	3	Do. 3 p.c. Deb. . .	54—57	..	..
784,000	,,	Sept. 12	6½	6½	Do. 6½ p.c. Red. Db.	98—100	..	..
91,500	,,	Aug. 15	8½	8½	South Shields Con. . . .	109—111d	..	..
1,543,795	,,	July 25	6½	6½	South Suburban Ord. 5 p.c.	101—104	..	101½
468,837	,,	June 27	5	5	Do. 5 p.c. Deb.	94—97	..	94
647,740	,,	Aug. 15	5	5	South'mpton Ord. 5 p.c max.	77—80	..	..
191,275	,,	June 27	4	4	Do. 4 p.c. Deb.	70—73	..	..
179,014	,,	July 25	8	8	Sutton Ord.	116—119	..	..
67,828	,,	June 27	5	5	Do. 5 p.c. Deb. . .	90—93	..	..
260,000	,,	Feb. 21	7	7	Swansea 7 p.c. Red. Pref. .	100—102	..	..
900,000	,,	June 27	6½	6½	Do. 6½ p.c. Red. Deb.	100—102	..	..
1,002,275	,,	Aug. 15	6⅝	6⅝	Tottenham District Ord. .	101—106	..	104
150,000	,,	,,	5½	5½	Do. 5½ p.c. Pref.	97—100	..	..
191,255	,,	Dec. 5	4	4	Do. 4 p.c. Deb.	72—75*	..	..
389,094	,,	Aug. 29	7	7	Uxbridge, Maidenhead, & Wycombe 5 p.c. . . .	97—102	..	..
88,880	,,	,,	5	5	Do. 5 p.c. pref. .	85—90	..	..
80,000	,,	July 11	9	9	Wandsworth, Wimbledon, and Epsom— Wandsworth A 5 p.c. .	135—140	..	..
356,836	,,	,,	7½	7½	Do. B 8½ p.c. .	112—117	..	..
433,535	,,	,,	6⅜	6⅜	Do. C and New	95—100	..	..
353,000	,,	,,	7½	7½	Do. Wimbledon 5 p.c. .	105—110	..	..
98,000	,,	,,	7⅝	7⅝	Do. Epsom 5 p.c. . .	113—118	..	..
80,000	,,	,,	5	5	Do. 5 p.c. Pref . . .	87—92	..	..
88,416	,,	June 27	3	3	Do. 3 p.c. Deb. . . .	54—57	..	..
284,748	,,	,,	4	4	Do. 4 p.c. Deb. . . .	74—77	..	..
207,500	,,	,,	5	5	Do. 5 p.c. Deb. . . .	93—96	..	..

Quotations at: *a.*—Bristol. *b.*—Liverpool. *c.*—Nottingham. *d.*—Newcastle. *e.*—Sheffield. *f.*—The quotation is per £1 of Stock. * Ex. div. † Paid free of income-tax. ‡ For year.

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With one exception Peter is an ordinary little fellow. Chubby, likeable, just five-and-a-half, full of life and fun and on occasions—be it admitted—of naughtiness.

Just now Peter's rather important, for this is his first term at school, and he's grappling with the intricacies of "A B C" and "Twice Two": difficult subjects to all men of five-and-a-half, but even more difficult in Peter's case because—bad luck—he's totally blind. That's his One Exception.

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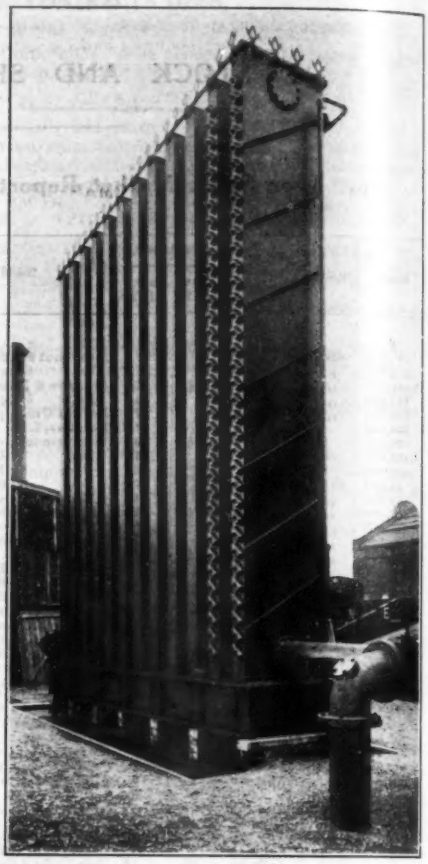

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By order,
GEO. LIVSEY,
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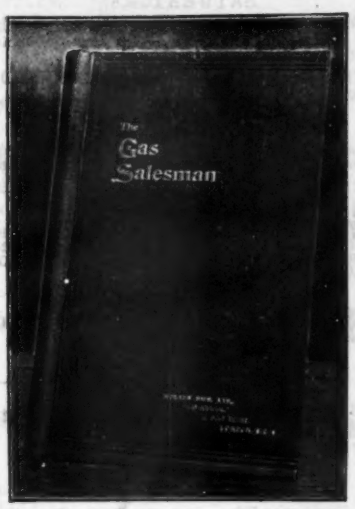

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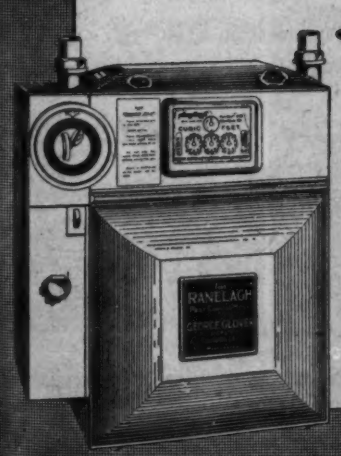

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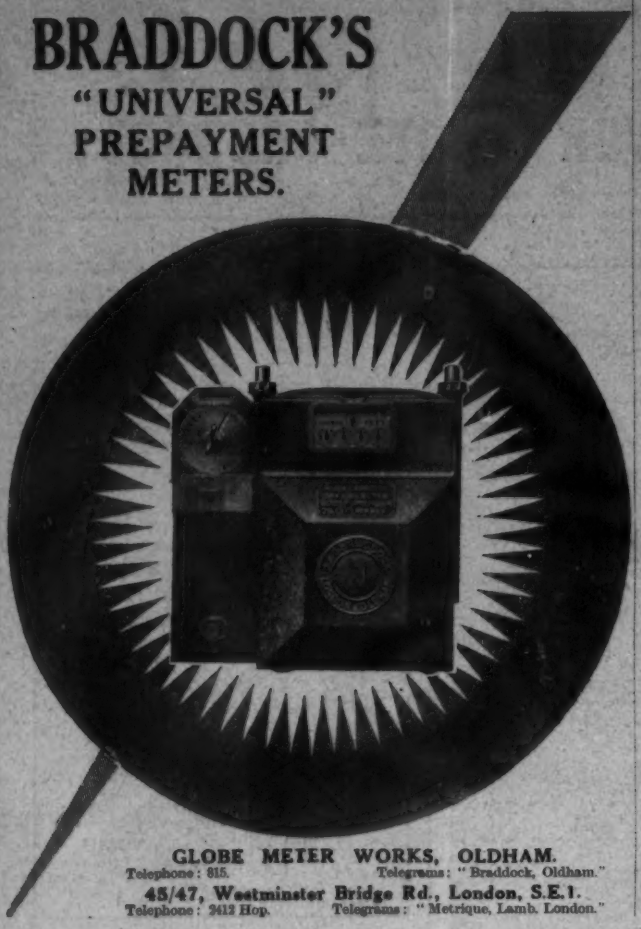

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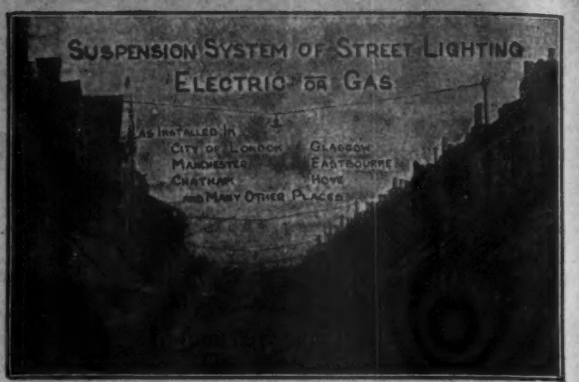

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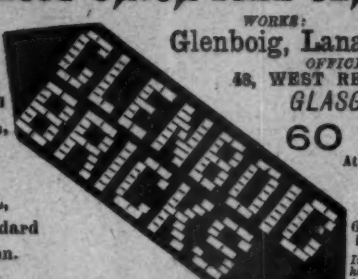

60 PRIZE MEDALS At International and Home Exhibitions, including Grand Prize at Brussels, 1910.
In every case the highest award given for Fire Clay Goods.

The Glenboig Bricks, Blocks, and Retorts combine, in the highest degree, the qualities of not melting, and not splitting, when subjected to the highest heats and sudden changes of temperature, and are, in consequence, found to be economical, even in districts where the local bricks can be had at half the price.

Maintain a Constant Gas Pressure
BY INSTALLING
GAS METER REGULATORS

CHEAP. RELIABLE.

EFFICIENT. EASY TO FIT.

Fig. 669.

This is a specially light and efficient type of Regulator, screwed for W.I. Connection, with removable top cover for adjusting outlet pressure.
For inlet pressures up to 8" water pressure—outlet pressures adjustable from 1" to 3½".

SUITABLE FOR CHURCHES, HALLS, FACTORIES, SHOPS, WORKSHOPS, HOUSES, AND WHEREVER GAS IS USED.

LET US SEND YOU ONE ON TRIAL
There are thousands in use.

We also supply Regulators for Gas Services, Fires, Stoves, and Street Lamps.

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[Founded in 1849 as the "Journal of Gas Lighting."]

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"NESTOR" GAS HEATER

FOR RAISING THE TEMPERATURE OF GAS BEFORE DRY PURIFIERS

INCREASES THE EFFICIENCY WITHOUT COST

OF

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These Heat Interchangers are made in standard sizes to deal with 20,000 to 350,000 cu. ft. of gas per hour and over 80 have been installed in numerous stations throughout the country.

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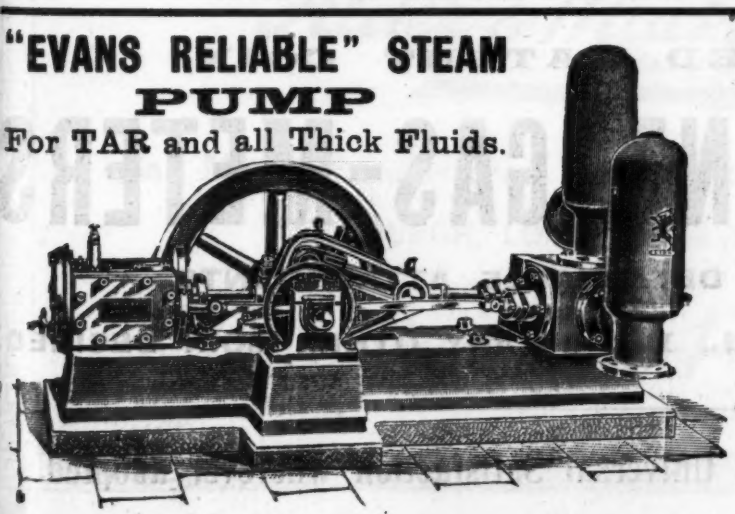
For TAR and all Thick Fluids.



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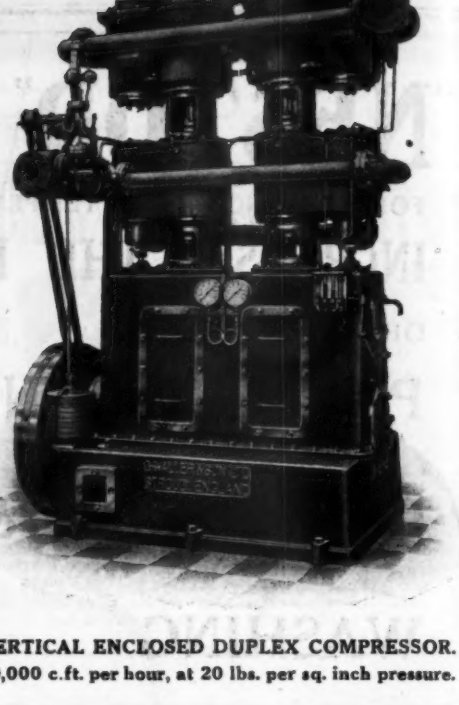
Vertical Enclosed Type

WHEN space is limited and the discharge pressure exceeds 5 lbs. per sq. inch, this type of Compressor is eminently suitable.

Totally enclosed and fitted with forced lubrication, a clean appearance is maintained and very little attention required. Complete range of sizes from 25,000 to 250,000 c.ft. per hour.

SINGLE, DUPLEX, STEAM TANDEM, GAS ENGINE, ELECTRIC, or BELT DRIVE



VERTICAL ENCLOSED DUPLEX COMPRESSOR.
80,000 c.ft. per hour, at 20 lbs. per sq. inch pressure.

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IMPROVED PATENT COIN

PREPAYMENT GAS-METERS

FITTED WITH DETACHABLE ATTACHMENTS.

ARRANGED FOR 1d., 6d., 1s., OR ANY OTHER COIN DESIRED.

These Meters are giving Universal Satisfaction wherever adopted.

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Gas Meter Manufacturers and Street Lighting Engineers

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"A. & M." Quality is Proverbial

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WITH

MANTLES

IN

ALIGNMENT.

BURNERS ALUMINISED

TO

PREVENT CORROSION.

No. 840 GA.

Fig. 900 GA.

Lists, Prices, and Samples on application.

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INCORPORATED IN PARKINSON & COWAN (GAS METERS), LTD.

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CHEAP TO PAINT
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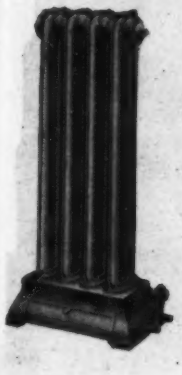
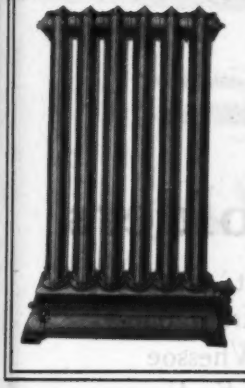
GAS HEATING





Wright's "Regulo"-controlled Gas Radiators fulfil all requirements in the heating of every class of building.

"Regulo"-controlled to maintain an even temperature and avoid wastage of gas, these Radiators are complete heating units in themselves. They are brought into or put out of commission in a moment and need no attention when in use.

Approved by the London County Council and used in some of the largest buildings in the country, Wright's "Regulo"-controlled Gas Radiators are made in a number of sizes and supplied in black, mahogany or old gold finishes.

A new edition of the "Loops of Heat" booklet is now available, and can be had on application to Department G.J.

WRIGHT'S

GAS RADIATORS

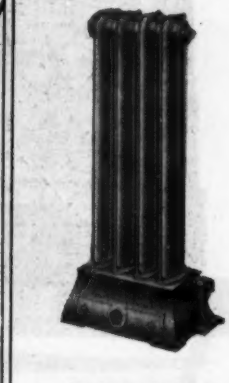
"REGULO"-CONTROLLED

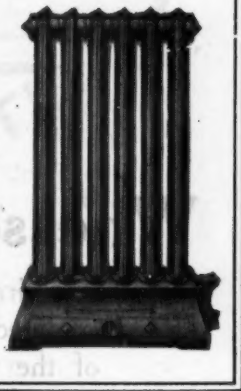
JOHN WRIGHT & CO.

Dept. G.J.

ESSEX WORKS, ASTON, BIRMINGHAM

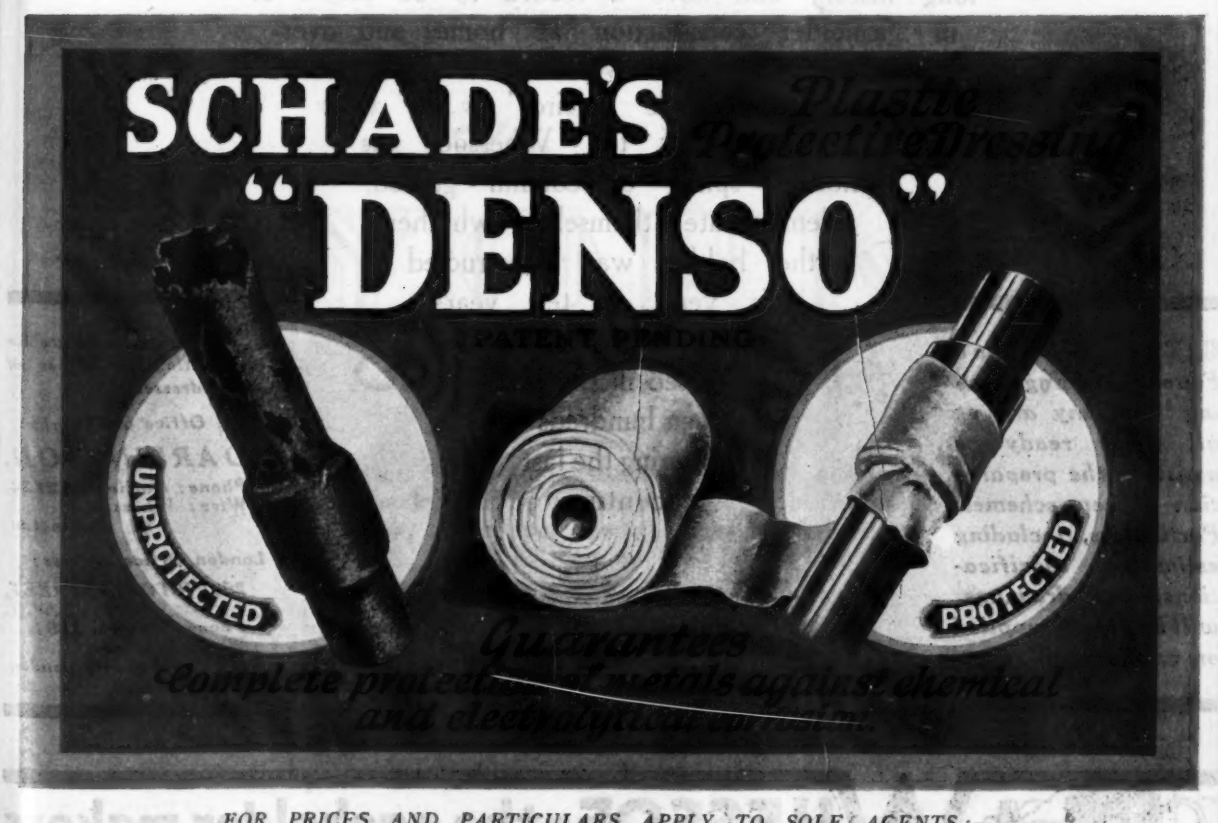
(Radiation Ltd., Proprietors)





OVER 4,000,000 YARDS IN USE.

SCHADE'S "DENSO"



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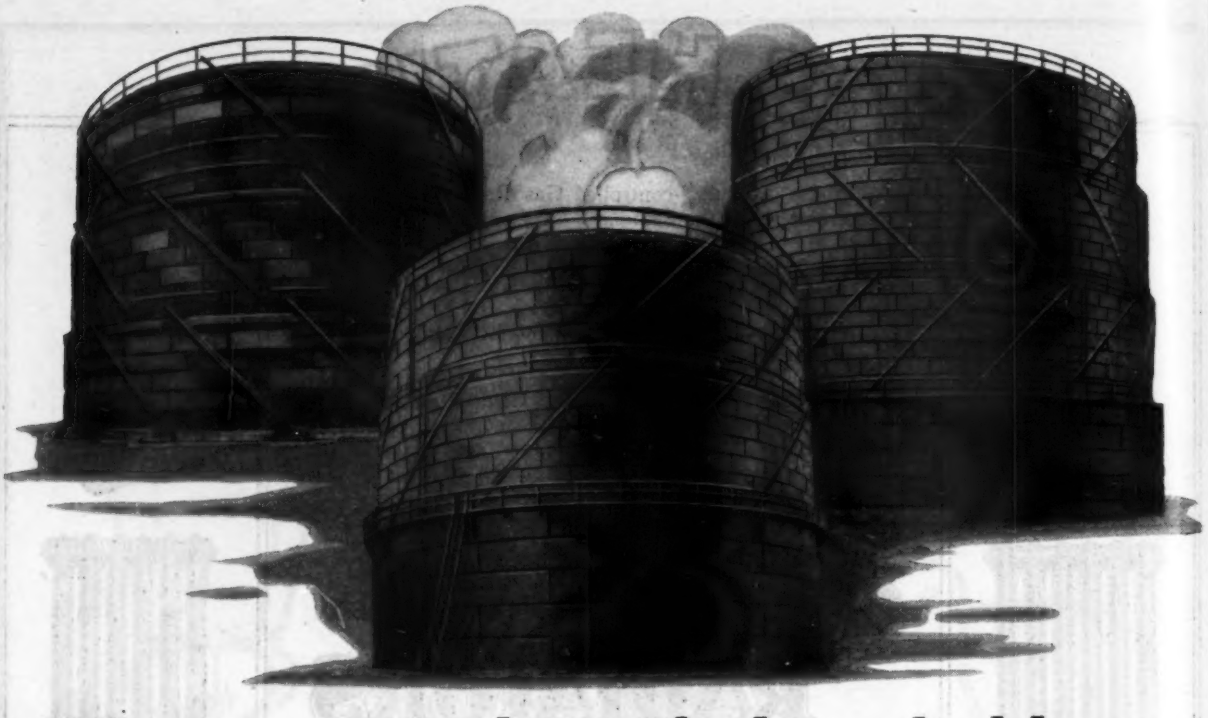

Whessoe spiral-guided gasholders

THE spiral-guided gasholders illustrated above are three recent contracts completed by us. We have already received a repeat order from one of the works for an exactly similar holder. ⚜ ⚜ ⚜ ⚜ Whessoe spirals are famed for the satisfaction they give. Such repeat orders form an added testimony of this undoubted fact. ⚜ ⚜ ⚜ ⚜ The Whessoe Company have had a long history and have a record to be proud of in gasholder construction at home and overseas. "There are Whessoe holders from Tokio to Rio de Janeiro." ⚜ ⚜ ⚜ ⚜ The merits of the Whessoe gasholder, spiral- or column-guided, demonstrate themselves whether the holder was constructed this year or ten years ago or whether it was erected in the nineteen hundreds or during the last century.

⚜ ⚜ ⚜
⚜ ⚜
⚜

¶ *The Whessoe Foundry and Engineering Company are at all times ready to assist in the preparation of new schemes. Particulars, including estimates, specifications, and drawings, will be gladly supplied on application.*

¶ *Please communicate for information to either of our addresses.*

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THE WHESSOE FOUNDRY AND ENGINEERING COMPANY, LTD.

ESTABLISHED 1790

WHESSOE-the gasholder makers

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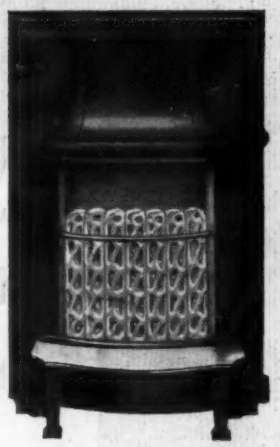
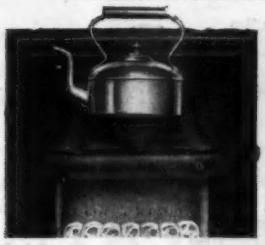




This shows the canopy, which is hinged, swung open to disclose the boiling-burner. When closed, the canopy gives no indication whatever of its useful contents (see illustration on left.)

DUAL PURPOSE – CONCEALED NEATLY!

Although a "most noticeable" advance, the boiling-burner device in the canopy of the Wilson "York" owes its popularity to being unnoticeable when not in use. This canopy, which is hinged, discloses a small but powerful boiling burner, and forms a perfectly secure boiling hob, very useful for the morning cup of tea, &c. The burner is separately controlled by a small tap on the right-hand side and is entirely independent of the gas fire itself.

The Wilson

YORK

GAS GRATE

with "BEAM" Radiants,
(Trade Mark)

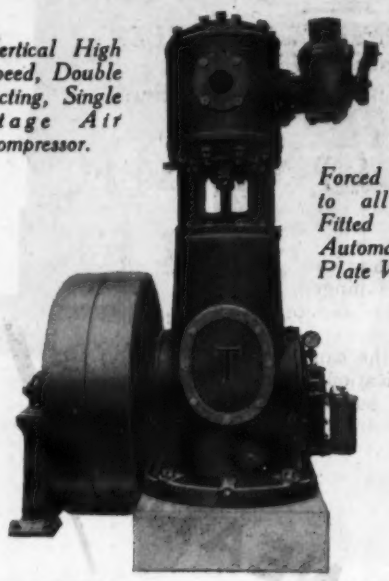
Radiation "Injector-Ventilator," patent adjustable flue nozzle, and concealable boiling burner. In art black, art copper, and armour bright finishes.

WILSONS & MATHIESONS LTD.
CARLTON WORKS, ARMLEY, LEEDS.

(Radiation Ltd., Proprietors.)

We Can Compress Both Gas and Air

Vertical High Speed, Double Acting, Single Stage Air Compressor.



Forced Lubrication to all Bearings. Fitted with our Automatic Multiple Plate Valves.

Tilghman's Air Compressor Co.,

Proprietors, Tilghman's Patent Sand Blast Co., Ltd.

BROADHEATH, near MANCHESTER

Telephone: Altrincham 540-541-542.
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TO ALL OUR CUSTOMERS

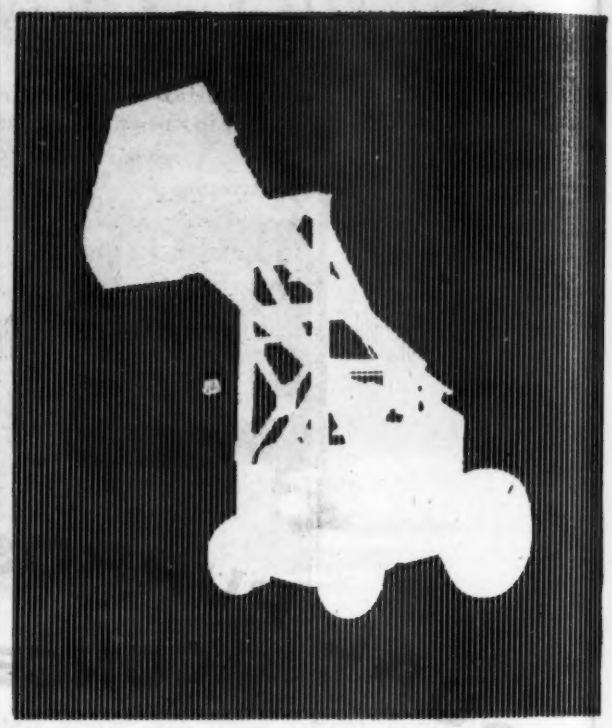
The Wholesale Fittings Co., Ltd.,

23/27, Commercial Street, LONDON, E.1.

Also at

BRISTOL AND MANCHESTER.

Chaseside Shovels



Even the Demonstration Model Sold . . . . .

Some of the things the Chaseside Shovel will do:

Move 25 tons from heap to hopper hourly.

Load a 5-ton lorry in 12 minutes at an all-in cost of 8½d.

Do the work of 5 to 12 men, according to working conditions.

Handle 1,250 tons of material per week (50 hours) at a total cost of £8.10.0, including all operating costs, such as wages, fuel, upkeep, depreciation, and interest on capital.

Load coal, coke, super, oxides, and fuel or by-products of a similar nature, into skips, lorries, railway wagons and barges.

The merit of the new 'K' type Chaseside Shovel can be gauged by the fact that although production has been increased, even the demonstration model has been sold.

Only a few more orders can be executed this year, but by the time this announcement appears, it is hoped that one Shovel will be ready for delivery.

Any good petrol motor driver can operate the Chaseside Shovel after a few hours' practice without the risk of a sudden or expensive breakdown being incurred, and if you are interested in a loading Shovel which will do the things detailed in the opposite column and pay for itself in 9 months into the bargain—then write for particulars of the New 'K' type Chaseside Shovels.

Please address your enquiries to the "Gas Sales" Dept.

CHASESIDE ENGINEERING CO.,

ENFIELD, LONDON, N.

Telephone - - - ENFIELD 1120-1.

Justifies your good opinion

You can confidently recommend the ECONOMIC GAS BOILER because it fulfils the most exacting demands of expert Gas Managers and Engineers. It retains heat for many hours, is economical and efficient.

Coloured BLUE.

The "ECONOMIC" Packed GAS WASH BOILER

"ECONOMIC" GAS BOILER

SPECIFICATIONS.

Made with double case from the best 22's W.G. Galvanized Steel, finished with two coats of Blue Stove Enamel, packed with Silicate Cotton. Aluminium Cast Top, Pan, Lid, and Condenser made from 12-lb. Rolled Copper. This Boiler being packed retains hot water for a number of hours after the Gas has been turned off; this is a decided advantage over other boilers. Made in 12, 14, 16, 18 and 20 gallon sizes if required.

You can serve your consumers by installing an "Economic" whenever asked for a gas wash boiler.

Prices for any quantity will gladly be supplied to any Gas Undertaking.

ECONOMIC GAS BOILER CO., LTD. GUY ST., GANNOW TOP, : BURNLEY. :

Complete incandescence!

"BEATRICE" GAS FIRES

The "Albion" Fire is the best value in 7 radiant fires on the market.

The "Beatrice" Fire, in vitreous enamel, as last season.

Fitted with Triple Disintegrating Injector.

Fire Brick Back and Burner can easily be removed for cleaning or replacement without dismantling the Fire from Grate.

Silent in Lighting, burning, and extinguishing.

A NEW MODEL
Finished in Black, with Nickel-plated Fender Top.
THE "ALBION"

The makers' name—JOHN HARPER & CO., LTD., of Willenhall—is an additional guarantee.

Sole Selling Agents in Great Britain and Ireland for Gas Fires manufactured by Messrs. John Harper & Company, Limited.

LET US QUOTE YOU.

ECONOMIC GAS BOILER CO., LTD.

GUY STREET, GANNOW TOP, BURNLEY

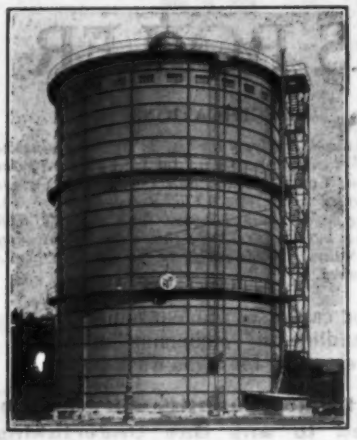
Telephone: 3305 Burnley. *Telegrams:* Bluboilers, Burnley.

THE KLONNE SYSTEM OF TANKLESS GASHOLDERS.

(Fully patented in all countries.)

BRITISH CONSTRUCTION THROUGHOUT.

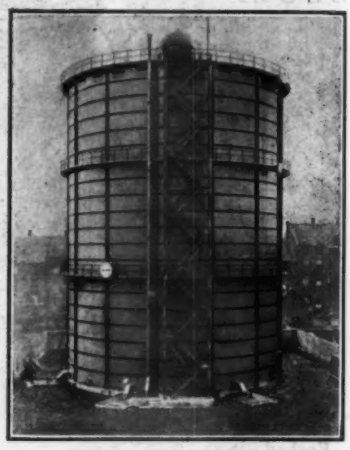
SIMPLE and RELIABLE.



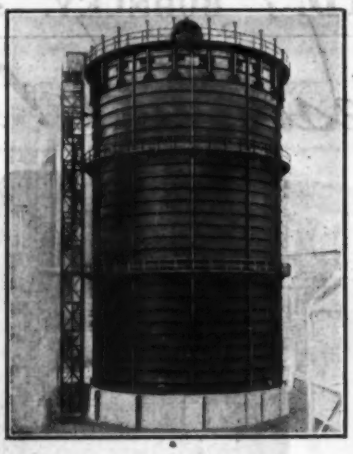
AUTOMATIC IN ACTION

NO TAR PUMPS

NO TAR SEAL



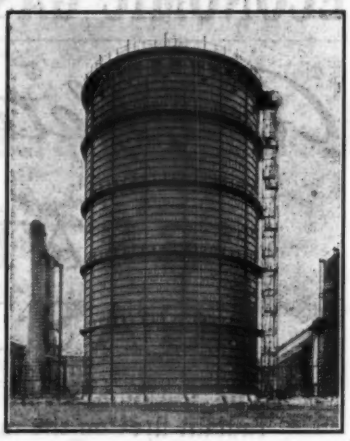
THE LAST WORD IN TANKLESS GASHOLDER CONSTRUCTION.



NO ATTENDANCE

DRY GAS

CONSTANT PRESSURE



8 Klonne Tankless Gasholders completed and working.

13 ,, ,, ,, under construction.

21 ,, ,, ,, ordered to date.

LICENSED MANUFACTURERS:—

SAML. CUTLER & SONS, LTD., 39, Victoria St., Westminster, S.W.1.

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THE HORSELEY BRIDGE & ENGINEERING CO., LTD., Tipton, Staffs.

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Ingot Iron

DRAWING, SPINNING and ENAMELLING SHEETS

Executed by Messrs. William Sugg & Co., Ltd., Westminster, with ARMCO Ingot Iron Drawing, Spinning and Enamelling Sheets.

A SPECIAL grade of enamelling sheet is supplied, processed to render it suitable for deep spinning and drawing operations for Gas Lamps, Reflectors, etc.

THESE articles, if made from steel, are liable to warp when vitreous enamelled, but distortion is avoided and a more perfect coating with lustre finish secured if "Armco" Ingot Iron is used.

The Armco International Corporation

(Incorporated with limited liability in Ohio, U.S.A.)

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London, S.W. 1

Telephone: VICTORIA 1426 and 1427. Telegrams: "ARMCOINGOT, SOWEST, LONDON."

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ASHMORE, BENSON, PEASE & Co LTD
GAS PLANT MANUFACTURERS
PARKFIELD WORKS
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Condensers of all Capacities and Types

Instal NEWBRIDGE Public Lighting Controllers and ensure "no-trouble" lighting seasons.

The
Directors and Staff
of
The Horstmann Gear Co., Ltd.,
join in wishing all their friends in the Gas Industry

A Happy Christmas
and
A Prosperous New Year

Newbridge Works - - Bath

A New Year Resolution—
Push the domestic gas lighting load and use NEWBRIDGE Positive Distance GAS SWITCHES.

An entirely new development in Gas Grate design!

UNIQUE in its departure from the ordinary, the "Lancet" is a gas grate that reflects the skill of the designer in embodying the characteristics of Gothic design in the creation of a gas grate with an entirely new outline.

In design the "Lancet" is entirely different from anything that has hitherto been produced, with an innovation in the fitting of mirror-like side reflectors which give a most pleasing effect when the fire is alight. The "dogs" are a special feature of the "Lancet" Gas Grate by reason of their unusual character.

ARDEN HILL'S

"LANCET"

GAS GRATE.

ARDEN HILL & CO., BIRMINGHAM.

(Radiation Ltd., Proprietors.)

HUMPHREYS & GLASGOW, LTD.

WATER-GAS

	Cu. Ft. Daily
Aarhus	800,000
Abertillery	500,000
Abertillery	100,000
Admiralty:	
British	500,000
British	800,000
British	800,000
British	800,000
British	800,000
French	800,000
French	800,000
Agram	200,000
Airdrie	430,000
Aldershot	1,400,000
Aldershot	1,000,000
Aldershot	1,316,000
Algiers	1,760,000
Alkmaar	460,000
Allenstein	200,000
Alost	700,000
Amerafoort	300,000
Amsterdam	1,000,000
Amsterdam	1,000,000
Amsterdam	2,700,000
Amsterdam	1,350,000
Antwerp	1,500,000
Antwerp	1,000,000
Antwerp	1,500,000
Antwerp	1,900,000
Arundel	215,000
Ascot	423,000
Ashford	250,000
Asnières	650,000
Augsburg	425,000
Aylesbury	150,000
Aylesbury	470,000
Banbury	200,000
Banff	125,000
Barmen	500,000
Barnsley	588,000
Barrow	300,000
Barrow	500,000
Barry	500,000
Barry	720,000
Bath	1,000,000
Bath	1,000,000
Bath	1,300,000
Bath	1,200,000
Bedford	1,000,000
Belfast	1,700,000
Belfast	4,500,000
Belfast	1,250,000
Belfast	1,250,000
Belfast	2,250,000
Benrath	125,000
Berkhampstead	259,000
Berlin:	
Charlottenb'g	2,500,000
Danziger Str.	1,600,000
Neukoelin	650,000
Neukoelin	700,000
Schmargendorf	760,000
Tegel	3,500,000
Tegel	6,350,000
Tegel	245,000
Berne, Switz.	725,000
Bexhill	400,000
Bideford	258,000
Bilston	375,000
Bilston	125,000
Birmingham:	
Adderley St.	675,000
Adderley St.	950,000
Nechells	3,000,000
Nechells	3,000,000
Nechells	3,000,000
Nechells	7,650,000
Swan Village	1,500,000
Windsor St.	3,000,000
Windsor St.	3,000,000
Windsor St.	6,100,000
Bishop's Stortford	200,000
Bishop's Stortford	300,000
Bishop's Stortford	200,000
Blackburn	1,190,000
Blantyre	150,000
Blois	125,000
Blois	125,000
Bochum	530,000
Bognor	100,000
Bognor	423,000
Bognor	500,000
Bo'ness	125,000
Boulogne	340,000
Bournemouth	1,000,000
Bournemouth	500,000
Bournemouth	1,500,000
Bournemouth	1,000,000
Bournemouth	500,000
Bournemouth	1,530,000
Bournemouth	2,000,000
Bournemouth	500,000
Bournemouth	2,750,000
Bremen	550,000
Bremen	950,000
Bremen	850,000
Brentwood	250,000
Brescia	588,000
Brescia	588,000
Brest	550,000
Bridgwater	200,000
Bridlington	150,000
Bridlington	200,000
Bridlington	550,000
Brieg	100,000
Brierley Hill	250,000
Brierley Hill	425,000
Brighton	1,750,000
Brighton	1,850,000
Brighton	750,000
Brighton	2,750,000
Brighton	3,000,000
Bristol	2,000,000
Bristol	2,500,000
Bristol	825,000
Bristol	825,000
Bromley	1,500,000
Bruges	200,000
Bruges	600,000
Brussels:	
Anderlecht	350,000
Anderlecht	350,000
Forest	1,000,000
Forest	1,000,000
Forest	1,000,000
Forest	1,500,000
Forest	88,000
Koekelberg	1,000,000
St. Gilles	1,000,000
St. Josse	1,000,000
St. Josse	800,000
St. Josse	775,000
Ville	750,000
Ville	750,000
Ville	1,500,000
Ville	350,000
Bucarest	1,100,000
Buckie	164,000
Budapest	50,000
Budapest	1,750,000
Budapest	200,000
Budapest	250,080
Burnley	1,350,000
Caen	350,000
Cambridge	500,000
Cambridge	1,000,000
Cambridge	1,700,000
Cardiff	2,000,000
Cardiff	3,000,000
Cardiff	1,950,000
Cardiff	600,000
Carlisle	600,000
Carlsruhe	500,000
Carnarvon	248,000
Charleroi	1,250,000
Châtesauroux	125,000
Châtesauroux	135,000
Châtelet	500,000
Chester	564,000
Chesterfield	430,000
Chesterfield	90,000
Chesterton	197,000
Chichester	250,000
Chorley	300,000
Cie. des Compteurs	1,150,000
Cie. Lorraine de Ch.	210,000
Cie. Mines de Roche	585,000
Coatbridge	400,000
Commercial, L'n	850,000
Commercial	850,000
Commercial	1,250,000
Commercial	2,000,000
Commercial	800,000
Commercial	2,100,000
Copenhagen	700,000
Copenhagen	2,500,000
Copenhagen	1,750,000
Copenhagen	1,200,000
Courtrai	250,000
Coventry	600,000
Coventry	600,000
Coventry	800,000
Coventry	1,250,000
Coventry	350,000
Cowdenbeath	420,000
Cracow	200,000
Cracow	200,000
Cranleigh	188,000
Crefeld	500,000
Crewe	700,000
Crewe	800,000
Crosfield & Sons	1,500,000
Crosfield & Sons	1,500,000
Crowborough	150,000
Croydon	1,250,000
Croydon	625,000
Croydon	625,000
Croydon	550,000
Croydon	650,000
Croydon	1,125,000
Croydon	150,000
Croydon	3,000,000
Croydon	6,000,000
Deal	250,000
Deal	250,000
Debreczin	100,000
Derby	1,500,000
Derby	2,000,000
Deventer	150,000
Deventer	200,000
Devonport	1,600,000
Devonport	1,100,000
Doncaster	1,350,000
Dorking	150,000
Dorking	300,000
Dorking	130,000
Dover	500,000
Dublin	2,000,000
Dublin	2,000,000
Dublin	650,000
Dudley	600,000
Dundee	1,500,000
Dundee	1,650,000
Dunedin, N.Z.	150,000
Dunedin	275,000
Durham	200,000
Dusseldorf	1,000,000
Eastbourne	1,250,000
Eastbourne	1,550,000
Edinburgh	2,000,000
Eindhoven	1,500,000
Enschede	282,000
Epping	500,000
Epsom	225,000
Epsom	300,000
Essen	1,400,000
Essen-Borbeck	1,400,000
Exeter	1,100,000
Exeter	1,200,000
Exmouth	376,000
Falmouth	150,000
Falmouth	200,000
Faversham	200,000
Flensburg	300,000
Flensburg	125,000
Fond. del Pignone	164,000
Forst	300,000
Frankenthal	175,000
Fuel Research Wks.	500,000
Fuel Research Wks.	500,000
Furnes	500,000
Gablonz	140,000
Gas L. & C. Co.:	
Beckton	10,000,000
Beckton	7,000,000
Beckton	3,500,000
Beckton	7,000,000
Beckton	7,000,000
Beckton	5,250,000
Beckton	4,500,000
Beckton	3,000,000
Beckton	1,500,000
Bow Common	1,000,000
Bow Common	1,150,000
Bow Common	150,000
Brentford	1,200,000
Brentford	350,000
Brentford	350,000
Brentford	750,000
Bromley	3,750,000
Bromley	2,250,000
Bromley	1,000,000
Bromley	1,000,000
Bromley	1,000,000
Bromley	1,450,000
Bromley	1,350,000
Fulham	2,500,000
Fulham	1,700,000
Ilford	650,000
Ilford	750,000
Kensal Green	2,250,000
Kensal Green	2,250,000
Kensal Green	2,250,000
Nine Elms	2,750,000
Nine Elms	750,000
Nine Elms	1,870,000
Nine Elms	2,850,000
Shoreditch	900,000
Shoreditch	2,700,000
Shoreditch	2,725,000
Southall	2,000,000
Southall	3,000,000
Staines	600,000
Stratford	1,700,000
Stratford	850,000
Stratford	2,350,000
Stratford	2,350,000
Gelsenkirchen	175,000
Gelsenkirchen	350,000
Geneva	500,000
Geneva	700,000
Geneva	1,270,000
Gennevilliers	10,600,000
Gennevilliers	2,900,000
Girvan	235,000
Glasgow	3,000,000
Glasgow	2,500,000
Glasgow	2,250,000
Glossop	340,000
Gloucester	900,000
Gloucester	1,000,000
Gosport	200,000
Gosport	225,000
Göteborg	300,000
Göteborg	600,000
Graudenz	200,000
Grays	250,000
Grays	400,000
Grays	725,000
Groningen, Holland	500,000
Guest Keen & Piggotts, Ltd.	1,936,000
Guildford	350,000
Guildford	200,000
Guildford	350,000
Guildford	1,100,000
Guildford	150,000
Haarlem	850,000
Hamburg	1,750,000
Hampton Court	500,000
Hampton Court	600,000
Hampton Court	1,100,000
Hanley	800,000
Hanley	800,000
Hartlepool	750,000
Hartlepool	765,000
Hastings	1,250,000
Haywards Heath	470,000
Hebden Bridge	200,000
Heidelberg	200,000
Hereford	525,000
Hertford	197,000
Hertford	944,000
Hessle	150,000
Heywood	500,000
High Wycombe	752,000
Hilversum	850,000
Hinckley	250,000
Holyhead	197,000
Hong Kong	450,000
Hong Kong	450,000
Hornsey	1,000,000
Hornsey	1,000,000
Hornsey	750,000
Hornsey	750,000
Horsham	235,000
Hull	1,500,000
Hull	1,000,000
Hull	1,600,000
Innsbruck	200,000
Ipswich	750,000
Ipswich	1,250,000
Ipswich	600,000
Jersey	564,000
Jersey	564,000
Kampen	350,000
Karlsbad	350,000
Kendal	329,000
Kidsgrove	235,000
Kiel	1,000,000
Kiel	880,000
Kilmarnock	800,000
Kilmarnock	585,000
King's Lynn	197,000
King's Lynn	400,000
Kingston-on-Th.	3,400,000
Kirkintilloch	360,000
Kirkintilloch	627,000
Kolozvar	100,000
Lancaster	500,000
Langley Mill	500,000
Largs	235,000
Lausanne	250,000
Lausanne	385,000
Lausanne	970,000
Le Mans	420,000
Lea Bridge	350,000
Lea Bridge	350,000
Lea Bridge	400,000
Lea Bridge	1,000,000
Lea Bridge	1,500,000
Lea Bridge	1,530,000
Leamington	800,000
Leamington	525,000
Leatherhead	705,000
Leeds	1,500,000
Leeuwarden	400,000
Leiden	500,000
Leiden	575,000
Leigh	350,000
Lemberg	360,000
Lemberg	500,000
Letchworth	362,000
Letchworth	423,000
Liége	1,000,000
Liége	750,000
Lille	860,000
Lincoln	500,000
Lincoln	893,000
Liverpool	3,500,000
Liverpool	4,500,000
Liverpool	750,000
Liverpool	1,750,000
Liverpool	1,250,000
Liverpool	3,000,000
Liverpool	1,500,000
Liverpool	1,250,000
Liverpool	2,350,000
Long Eaton	430,000
Long Eaton	170,000
Longton	600,000
Louvain	800,000
Lubeck	400,000
Luton	400,000
Maastricht	200,000
Macclesfield	800,000
Magdeburg	1,400,000
Maidenhead	225,000
Maidenhead	225,000
Maidenhead	175,000
Maidenhead	175,000
Maidenhead	200,000
Maidenhead	200,000
Maidstone	500,000
Maidstone	500,000
Malines	500,000
Malines	575,000
Malmö	350,000
Malta	400,000
Manchester	3,500,000
Manchester	3,500,000
Manchester	1,500,000
Mansfield	330,000
Mansfield	493,000
Margate	960,000
Marlborough	100,000
Mayence	700,000
Melbourne	5,000,000
Merthyr Tydfil	300,000
Merthyr Tydfil	200,000
Middlesbrough	1,250,000
Middlesbrough	750,000
Middlesbrough	500,000
M/M. Woolston	9,000,000
Monaco	275,000
Monaco	618,000
Monaco	618,000
Mons	500,000
Montevideo	1,222,000
Morecambe	333,000
Moscow	1,000,000
Munich	1,400,000
Namur	175,000
Narbonne	350,000
Nelson	400,000
Nelson	350,000
Neuss	140,000
Newbury	250,000
Newcastle	2,500,000
Newcastle, N.S.W.	500,000
Newhaven	235,000
Newport Pagnell	185,000
Nice	900,000
Nictheroy	250,000
N. Middlesex	150,000
N. Middlesex	200,000
N. Middlesex	75,000
N. Middlesex	650,000
N. Middlesex	650,000
N. Middlesex	1,000,000
North Sydney	500,000
North Sydney	500,000
Norwich	1,000,000
Norwich	300,000
Norwich	500,000
Norwich	1,500,000
Nottingham	1,000,000
Nottingham	1,000,000
Nuneaton	125,000
Oberhausen	175,000
Oldbury	500,000
Oldenburg	200,000
Ornskirk	170,000
Ostend	100,000
Ostend	200,000
" Zandvoorde	700,000
Palermo	968,000
Palermo	850,000
Paris:	
Clichy	4,000,000
Ivry	1,570,000
Landy	6,000,000
Landy	6,000,000
Landy	5,295,000
La Villette	4,000,000
La Villette	2,000,000
St. Mandé	1,570,000
Paris-Plage	125,000
Pau	550,000
Pavia	194,000
Pavia	212,000
Pembroke	240,000
Perigueux	350,000
Perth, W.A.	125,000
Perth, W.A.	1,000,000
Petone, N.Z.	200,000
Piggott & Co.	1,500,000
Plymouth	2,000,000
Poitiers	350,000
Pontypool	120,000
Port Elizabeth	400,000
Portsmouth	1,000,000
Portsmouth	2,000,000
Portsmouth	800,000
Portsmouth	2,000,000
Posen	450,000
Posen	700,000
Prague	140,000
Preston	1,400,000
Ramsgate	430,000
Reading	1,000,000
Reading	1,000,000
Reading	600,000
Redditch	500,000
Redhill	275,000
Redhill	300,000
Redhill	1,100,000
Reichenberg	200,000
Reichenberg	200,000
Reval	350,000
Rhymney	175,000
Rhymney	250,000
Riddings	258,000
Ripley	120,000
Rochester	2,200,000
Rochester	2,800,000
Romford	300,000
Romford	350,000
Romford	1,200,000
Rotterdam	850,000
Rotterdam	1,500,000
Rotterdam	750,000
Rotterdam	750,000
Rotterdam	600,000
Rotterdam	2,000,000
Royston (Yorks.)	250,000
Rugby	1,000,000
Rugby	450,000
Rushden	425,000
Rushden	517,000
Ryde	500,000
Saffron Walden	235,000
St. Albans	700,000
St. Albans	580,000
St. Andrews	210,000
St. Andrews	409,000
St. Gallen	225,000
St. Gallen	225,000
Ste. Ch.Gr. Paroisse	1,320,000
Sté. Kuhlmann	1,270,000
Sté. Kuhlmann	3,200,000
Sté. Kuhlmann	2,150,000
Sté. Tubes Meuse	545,000
San Paulo	700,000
Scarborough	800,000
Scarborough	300,000
Scarborough	350,000
Scarborough	1,300,000
Scarborough	1,350,000
Seaford	200,000
Shanghai	225,000
Shanghai	225,000
Shanghai	1,600,000
Shanklin	259,000
Shanklin	400,000
Sheerness	200,000
Sheerness	180,000
Sheerness	200,000
Sheerness	220,000
Sheffield	1,530,000
Sheffield	3,000,000
" Steel Prods.	5,000,000
Shirebrook	500,000
Shrewsbury	300,000
Shrewsbury	170,000
Sidmouth	225,000
Singapore	600,000
Sittingbourne	259,000
Southampton	800,000
Southampton	500,000
Southampton	600,000
Southampton	100,000
Southampton	1,000,000
Southampton	1,450,000
Southend	1,250,000
Southend	900,000
Southend	900,000
Southgate	403,000
Southgate	500,000
Southgate	800,000
Southgate	500,000
Southport	750,000
Southport	900,000
Southport	900,000
Southport	450,000
South Shields	650,000
South Shields	1,250,000
Stafford	500,000
Stettin	880,000
Stirling	400,000
Stirling	970,000
Stockholm	1,500,000
Stockholm	1,750,000
Stockport	600,000
Stockport	600,000
Stockport	400,000
Stockport	400,000
Stockton	500,000
Stockton	250,000
Stourbridge	500,000
Stourbridge	500,000
Sunderland	2,250,000
Sunderland	300,000
Sutton	1,269,000
Sutton	1,625,000
Swanage	300,000
Swansea	750,000
Swansea	1,000,000
Swansea	450,000
Swansea	1,250,000
Swansea	2,000,000
Swindon	300,000
Swindon	450,000
Swindon	400,000
Sydney	1,000,000
Sydney	1,000,000
Sydney	1,000,000
Sydney	1,000,000
Sydney	8,250,000
Taunton	225,000
Taunton	350,000
Tawe Valley	275,000
Teignmouth	200,000
The Hague	1,000,000
The Hague	500,000
The Hague	1,750,000
The Hague	1,500,000
The Hague	775,000
The Hague	1,500,000
The Hague	2,930,000
Tilbury	400,000
Tirlemont	120,000
Tokyo	2,000,000
Torquay	350,000
Torquay	350,000
Torquay	320,000
Tottenham	750,000
Tottenham	750,000
Tottenham	350,000
Tottenham	1,000,000
Tottenham	1,000,000
Tottenham	1,250,000
Tottenham	2,500,000
Tottenham	1,000,000
Tottenham	500,000
Tottenham	1,000,000
Toulouse	1,800,000
ToulouseNatl. Wks.	2,400,000
ToulouseNatl. Wks.	6,200,000
Tournai	700,000
Tours	550,000
Trowbridge	250,000
Trowbridge	150,000
Tunbridge Wells	1,000,000
Tunbridge Wells	1,000,000
Tunis	175,000
Tynemouth	1,100,000
Tynemouth	1,100,000
Ulm	400,000
Union Chim.-Belge	1,977,000
Utrecht	1,000,000
Utrecht	1,000,000
Uxbridge	752,000
Uxbridge	1,000,000
Vancouver	3,800,000
Verviers	1,000,000
Vevey, Switz.	650,000
Victoria, B.C.	500,000
Vienna	3,500,000
Vienna	2,500,000
Walsall	750,000
Walsall	375,000
Waltham	400,000
Waltham	140,000
Wandsbek	125,000
Wandsworth	1,800,000
Wandsworth	4,230,000
Wanganui, N.Z.	376,000
Ware	150,000
Ware	282,000
Warwick	125,000
Wasmuel	500,000
Watford	300,000
Watford	350,000
Watford	400,000
Watford	1,250,000
Wath	430,000
Weimar	100,000
Wellingborough	525,000
Wellingborough	525,000
Wellington, N.Z.	350,000
Wellington	300,000
West Bromwich	530,000
Westgate	250,000
Weston-Mare	350,000
Weston-Mare	350,000
Weston-Mare	150,000
Weston-Mare	150,000
Weston-Mare	500,000
Wexford	100,000
Weymouth	400,000
Weymouth	100,000
Weymouth	650,000
Whitstable	523,000
Widnes	500,000
Wiesbaden	850,000
Wigston	250,000
Winchester	225,000
Winchester	125,000
Winchester	410,000
Winchester	325,000
Woking	400,000
Wolverhampton	1,500,000
Wolverhampton	1,000,000
Wolverhampton	250,000
Wolverhampton	400,000
Worthing	525,000
Yarmouth	500,000
Yarmouth	125,000
Yeovil	340,000
Zwolle	200,000
Zwolle	200,000
Zwolle	700,000

904 *Sets of Humphreys-Glasgow Plant have been (and are being) installed with a capacity of over* **761,600,000** *cubic ft. of Water-Gas per diem. Including the work of their American Colleagues,* **1997** *Sets have been constructed with a total* **DAILY** *capacity of* **2,091,000,000** *cubic feet.*

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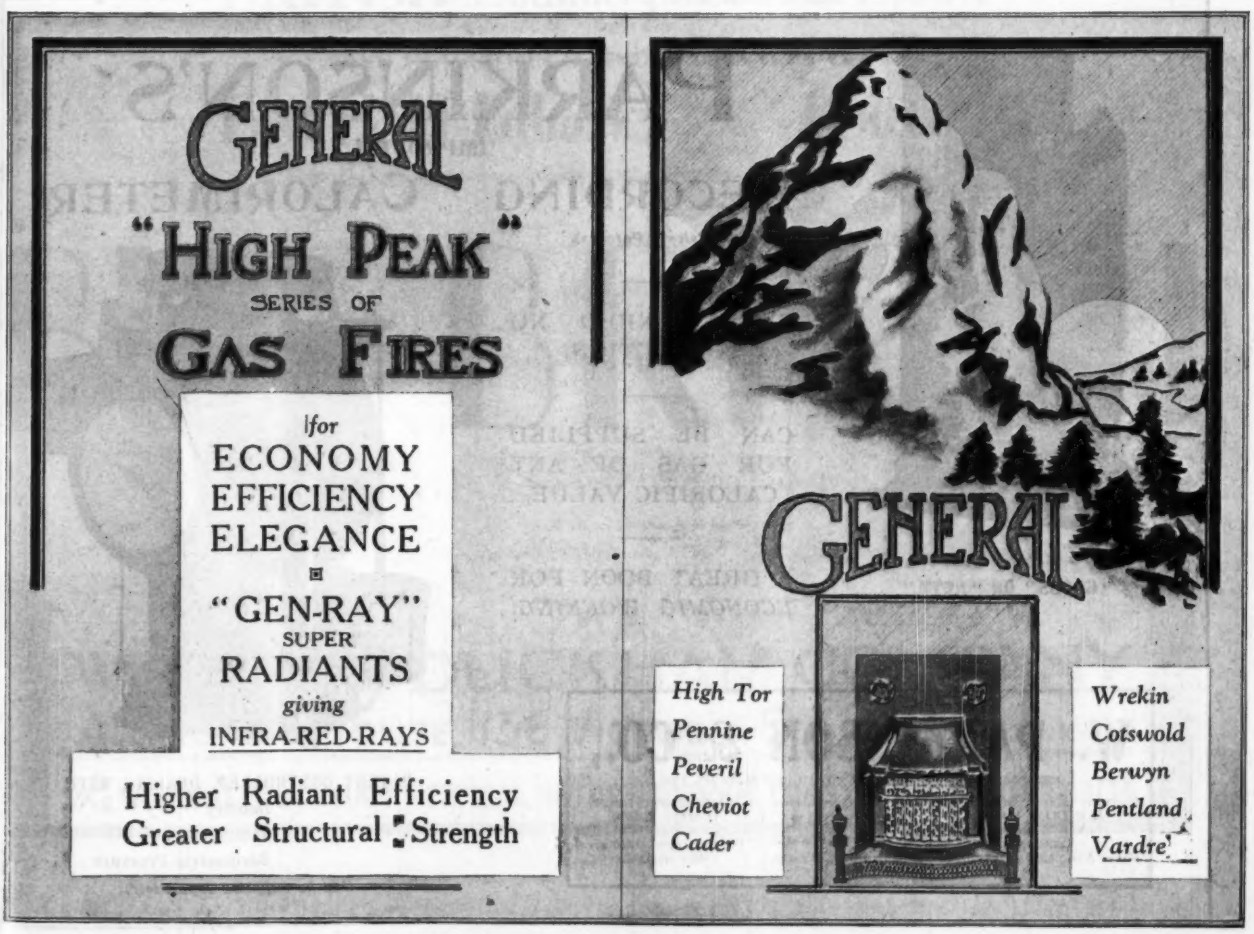

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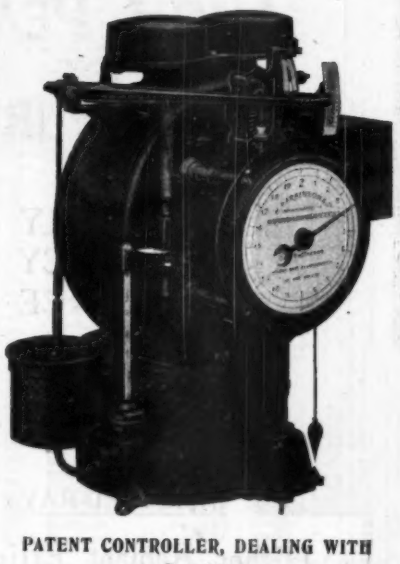

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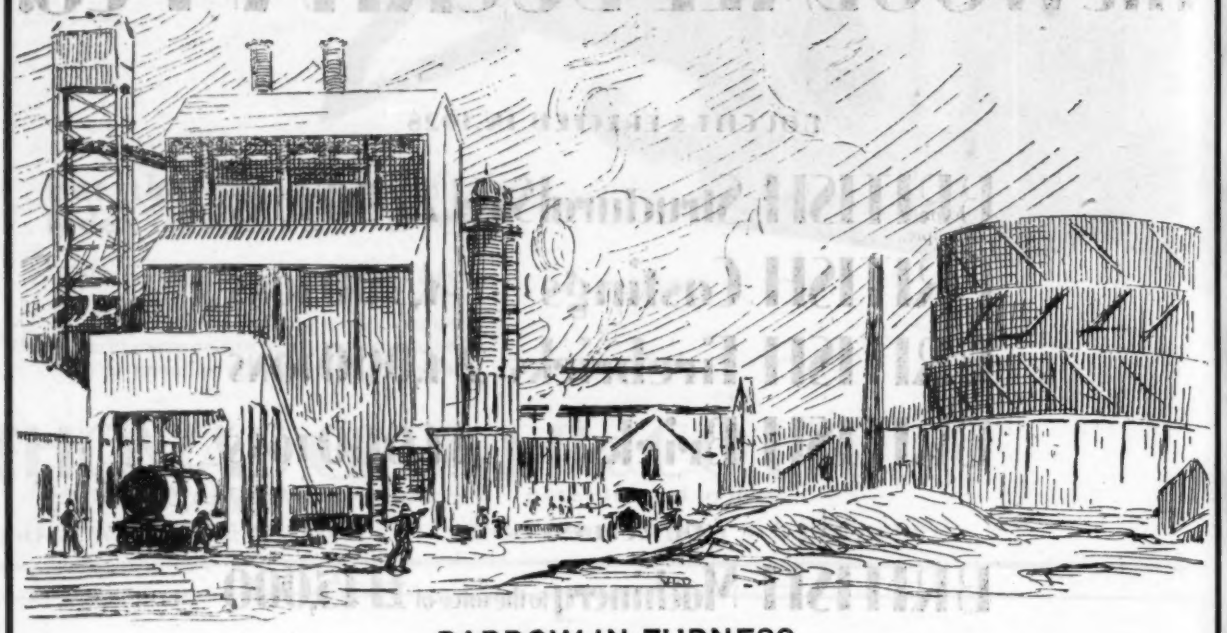

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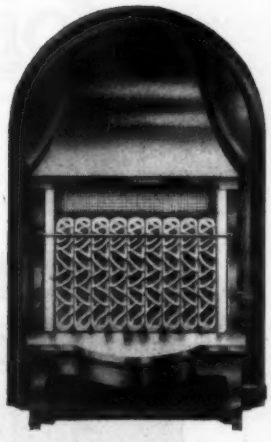

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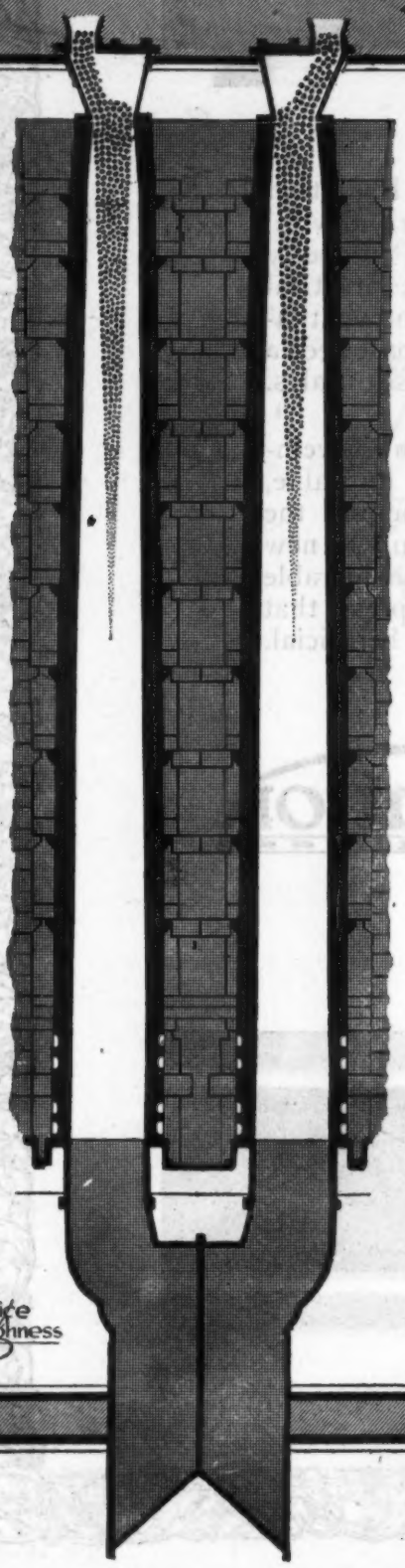

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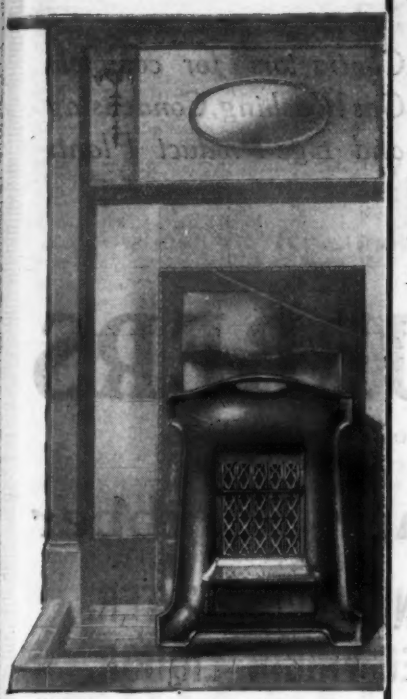

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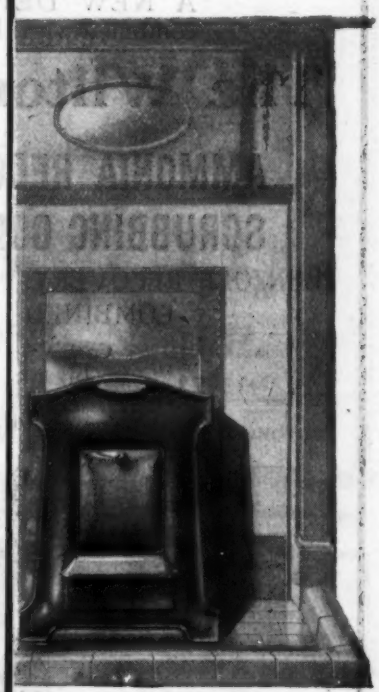

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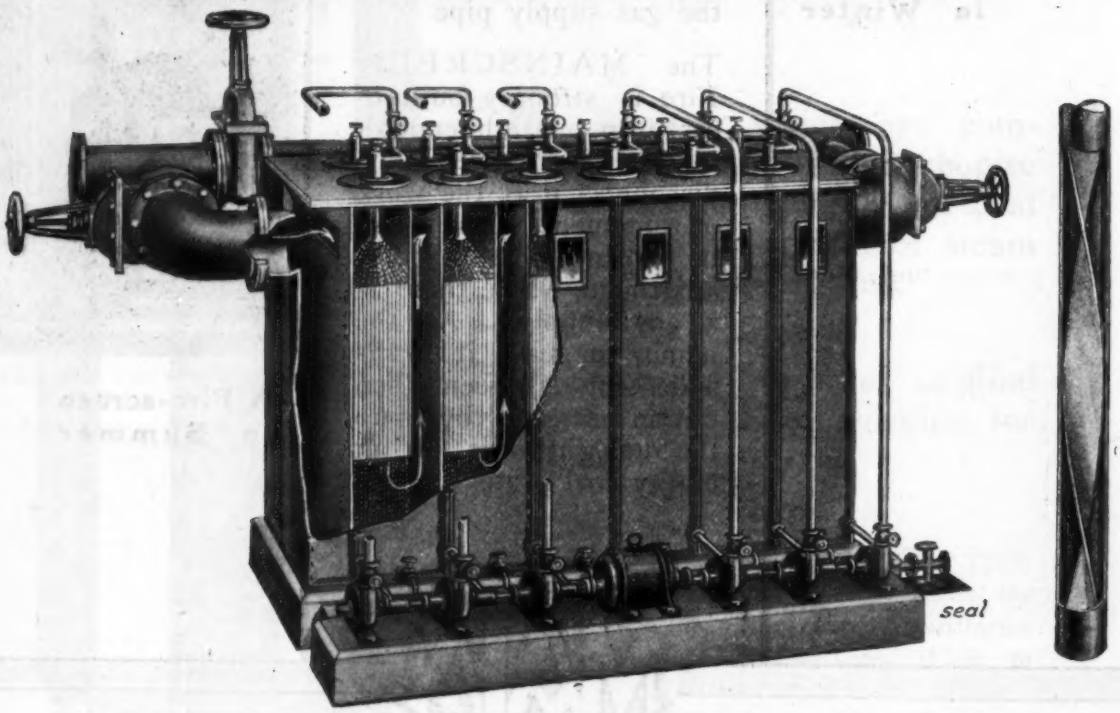

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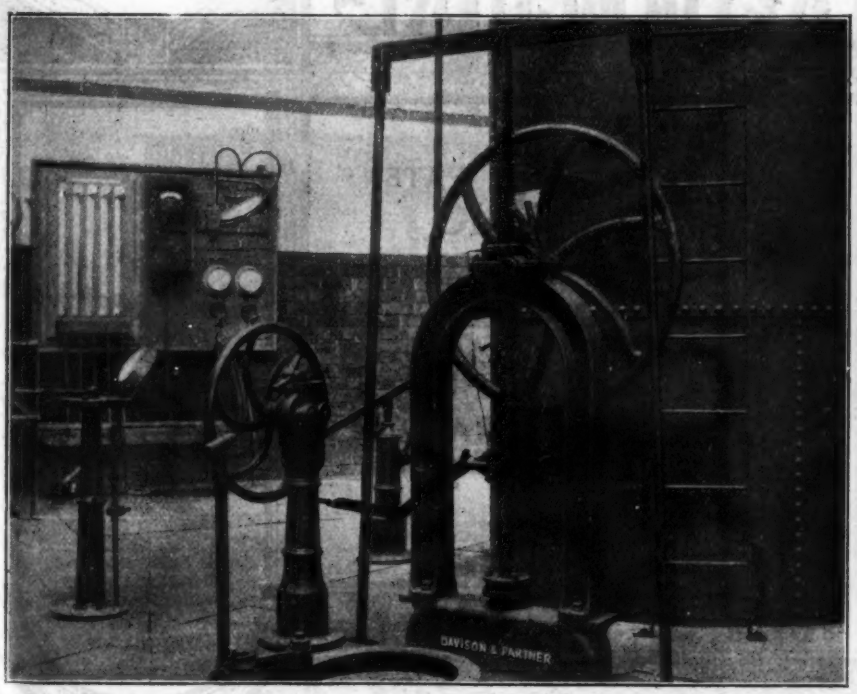

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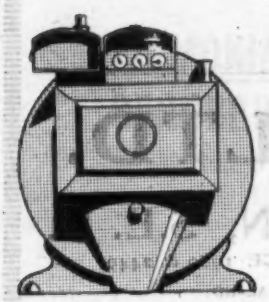

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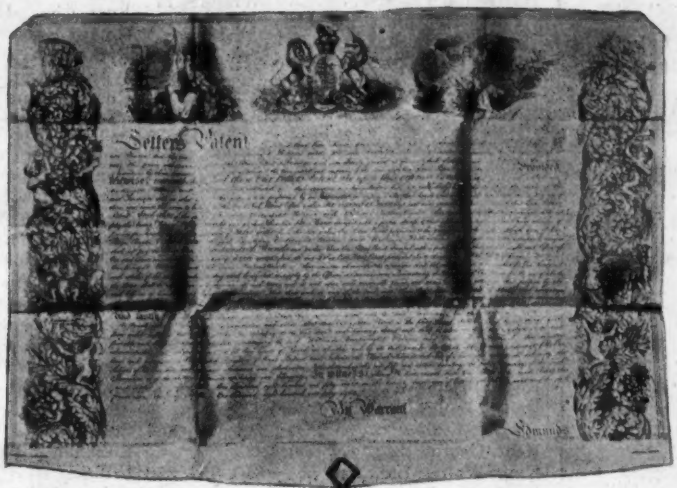

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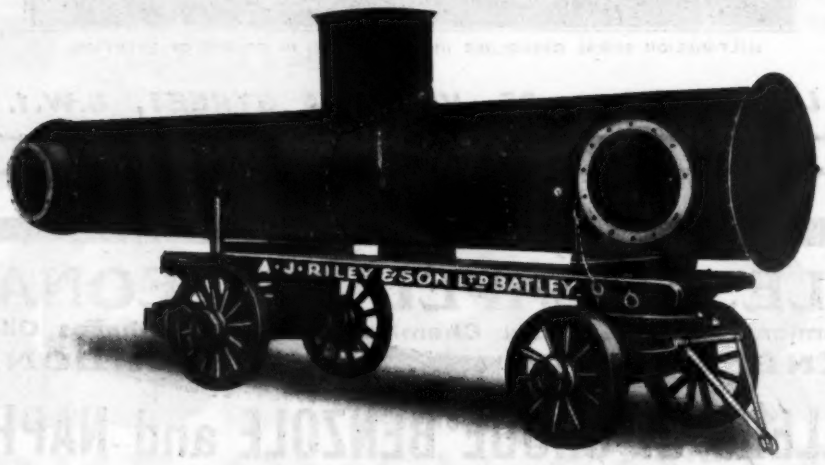

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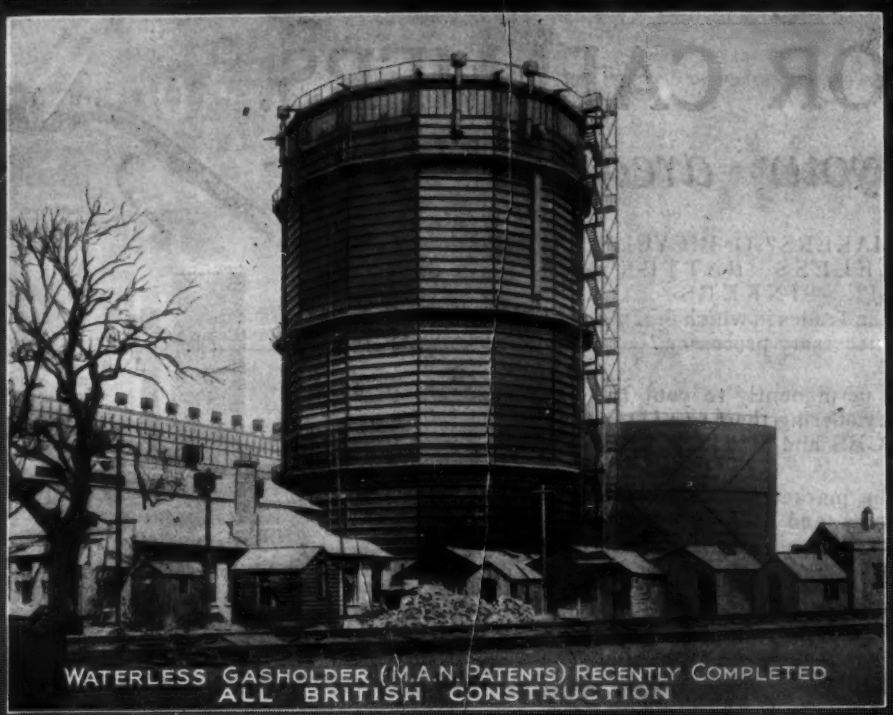

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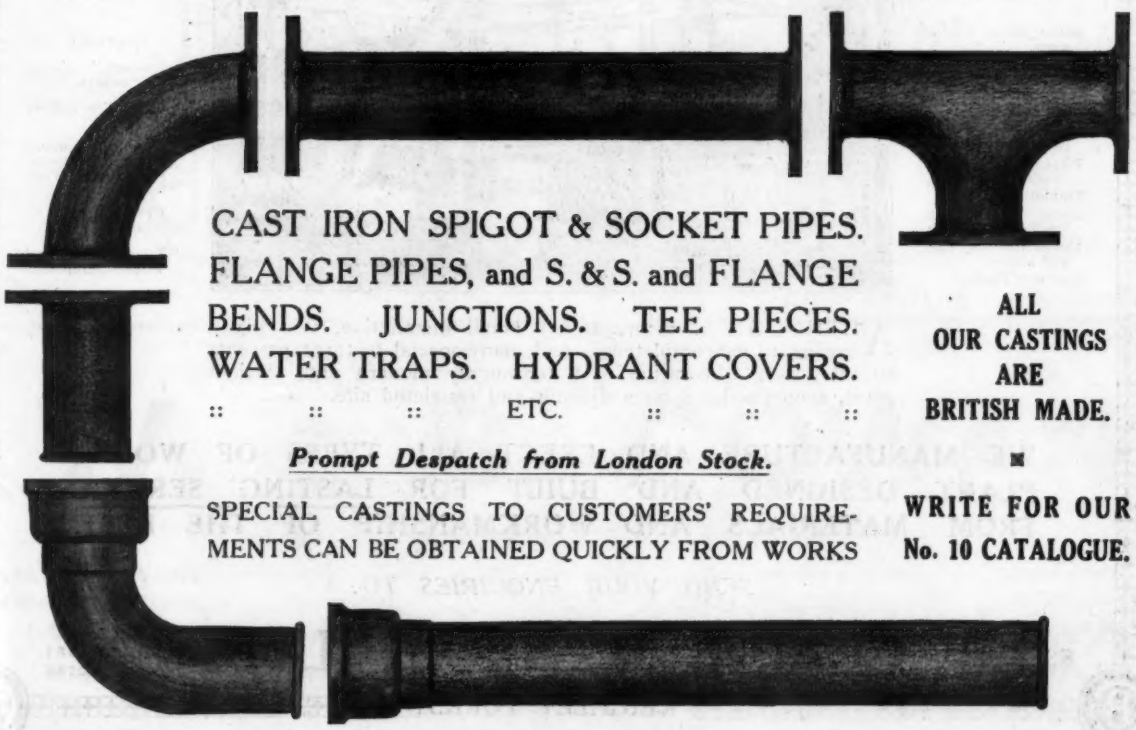

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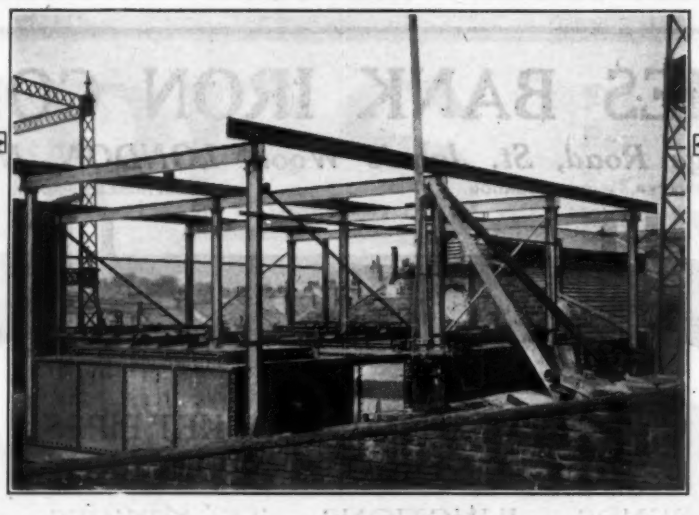

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